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THESIS

EFFECT OF BEING AN AVIATOR ON PROMOTION TO O-5 IN THE USMC

by

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March 2011

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13. ABSTRACT (maximum 200 words)

Marine Corps aviation is an imperative component of the storied Marine Air-Ground team. Marine aviation is a perishable skill, however, not only in tactical employment, but also in operational and strategic planning. The senior leadership of the Marine Corps needs the technical and tactical experience of Marine aviators. In July of 2009, the Marine Corps Deputy Commandant for Aviation (DCA) proposed a quantitative study of the decreased promotion rates of aviator majors (O-4) to lieutenant colonel (O-5). If true, decreasing promotion opportunity of Marine aviators presents risk to the Marine Corps *warfighting* institution, through the loss of valuable aviation technical and tactical experience in senior leadership.

The study is organized to answer the DCA's research question and to provide recommendation in how officers of the aviation component can be more competitive for promotion to O-5. The study draws upon nine years of Total Force Data Warehouse (TFDW) and Marine Manpower Support Branch (MMSB) data of Marine O-4s eligible for promotion, resulting in a dataset of 8,271 observations. The study's sample closely replicates the above and in-zone population of O-5 promotion cohorts from fiscal years 2004 through 2012. Analysis of the sample demonstrates that Marine aviators had a decreased selection opportunity to O-5 compared to all other MOSs, 62.3% versus 67.3%. Additionally, multivariate analysis was accomplished on the sample, which revealed a statistically significant and negative "aviator" effect of approximately 7.6 percentage points on promotion probability through various econometric model specifications. Traditional promotion selection notions are also affirmed in statistically significant and positive effects in individual performance (FITREP Relative Value), combat experience, Professional Military Education (PME), and above bachelor's degree education. Finally, a restricted model was designed to analyze the factors that differentiated those aviators selected for promotion and those non-selected. Statistically significant factors for aviator promotion selection to O-5 included being part of the fixed-wing community, holding an additional MOS as a Weapon and Tactics Instructor (WTI), completion of Intermediate Level School, and the Special Education/Advanced Degree Programs.

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EFFECT OF BEING AN AVIATOR ON PROMOTION TO O-5 IN THE USMC

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I. INTRODUCTION

A. BACKGROUND

The United States Marine Corps boasts an officer promotion system that is both equitable and successful. The Marine ethic of "every Marine a rifleman" is central to its system of officer promotion as the vast majority of active duty officers compete for the same promotion vacancies, regardless of military occupational specialty (MOS). In fact, the Marine rifleman ethic may have its greatest manifestation in the officer promotion system for this very reason. The "best and most qualified" Marine officers are selected for promotion each year; these selections are not based on any institutional favoritism towards a specific occupational community, or on any quantifiable manpower shortage within a particular specialization (Officer Promotion Manual, 2006, p. 3–9).[1]

B. PROBLEM

The "best and most qualified" promotion ethic of the Marine Corps is not without flaw, however, as it ignores any notion of intentional force structuring in MOS distribution through promotion selection. The aviator occupational field, in particular, has been singled-out by Marine leadership as an MOS that has experienced a decreasing rate of promotion selection to the rank of lieutenant colonel (or grade of O-5). A decreasing promotion opportunity for aviators incurs great risk to the Marine Corps through the potential loss of critical skills and experience in combat aviation. Senior leadership of the Marine Air-Ground Task Force (MAGTF) necessarily requires the representation of all elements that drive and support this key Marine combat.[2]

Marine Corps leadership has recently recognized this potential problem with the officer promotion system. In 2009, the Deputy Commandant for Aviation (DCA) drafted

[1] The "skill guidance" component of the promotion precept message suggests MOSs that warrant due consideration for shortages.

[2] The MAGTF is the Marine Corps' principal combat organization for conduct of operations across its spectrum of national defense responsibility. It is composed of four elements: command element (CE), ground combat element (GCE), aviation combat element (ACE), and logistics combat element (LCE). (Marine Corps Operations, 2001, p. 3–11).

a study proposal to investigate the alarming decrease in lieutenant colonel promotion rates of aviators (Deputy Commandant, Aviation, 2009). A non-statistical study was conducted in October of 2008 for the Marine Air Board on this assertion by the DCA. This initial study found that the ten-year average promotion rate for aviators to O-5 was below the overall average and significantly below that of the infantry MOS, by comparison. Though the decrease in promotion rates of aviators is in itself a problem worth investigating, the macro-level perspective of this situation necessitates analysis for more important reasons. "The results of this study will…inform DC, M&RA (Deputy Commandant for Manpower & Reserve Affairs) and DC, AVN (Deputy Commandant for Aviation) on the long term impacts of this promotion rate shift" (Aviation Call for Study Proposal, DCA, ASM-52, 2009). The DCA is concerned that the declining promotion rates of aviators will have long-term and derogatory consequences on the shape of the officer corps. The DCA is also concerned with the management of aviator's careers, standards for promotion selection, and retention.

The projection of infantry forces from sea to land is certainly the heart of the Marine Corps institution. "The only reason the United States of America needs a Marine Corps is to fight and win wars" (Leading Marines, 2002, p. 93). Necessarily, Marines with boots on the ground fighting directly with the enemy is an imperative to the nation's call on the Marine Corps. However, the MAGTF is a team that combines and exploits the many contributions and occupational expertise to place the enemy on the horns of an operational dilemma, from which there is no viable escape. In order to accomplish this warfighting concept, however, the senior officer leadership corps needs to be composed of Marines from all occupational fields. The Marine Corps cannot emphasize a particular occupational field in promoting senior officers, at the expense of other MOSs, without incurring operational risk. The current promotion system does not adequately address the need for intentional distribution of promotion selection of all occupational fields. Specifically, and in light of the DCA's recent findings of a decreasing promotion rate of aviators to O-5, the aviation field needs to be fairly represented in the senior officer ranks.

C. PURPOSE

The purpose of the study is to investigate the DCA's claim regarding the decrease in aviator promotion rates to lieutenant colonel. The study will investigate the factors that affect promotion of aviators and Naval Flight Officers (NFOs) to O-5, and briefly explore the long-term implications of an officer corps composed of fewer aviators with corresponding recommendations. Specific research questions are:

1. Primary Research Question

What is the probability of promotion to lieutenant colonel for a Marine Corps officer of the aviator MOS (75XX), compared to officers of other MOSs within the USMC?

2. Secondary Research Question(s)

Does the effect of being an aviator on the probability of promotion vary by individual's demographics, professional performance, operational history, T/M/S aircraft, and other aviator-specific variables?

D. SCOPE AND LIMITATIONS

The scope of the study will include both qualitative and quantitative components. The qualitative portion will include a description of the research problem, review of the current Marine Corps officer promotion policy, description of the general career track of Marine aviators, and a literature review of past promotion studies. The quantitative portion will be the most robust aspect of the study. Two independent sources will be referenced for personnel data on candidates for promotion to lieutenant colonel for statistical analysis. Total Force Data Warehouse (TFDW) data was compiled of Marine lieutenant colonel candidates from nine promotion board cohorts, FY 2004–2012. Additionally, the Marine Manpower Support Branch (MMSB) has provided personal performance data of these same promotion board cohorts, as described in fitness reports in the rank of major (O-4). The two independent datasets described were merged for aggregate multi-variable regression analysis. Hypotheses developed from the primary

and secondary research questions will be confirmed, denied, or found undetermined through statistical analysis and generally accepted statistics practices. The statistically significant findings of the regression analysis will be used to formulate conclusions and recommendations appropriate to the DCA's original study proposal. The study concludes with recommendations to the DCA for better management of the Marine aviator officer corps through promotion, affecting a long-term officer corps structure that leverages the unique technical and tactical expertise of the aviation MOS.

E. ORGANIZATION OF STUDY

The study is as follows. Chapter I articulates the origin and purpose of the study, detailing the primary and secondary research questions. Chapter II provides the policy framework of the current Marine officer promotion and performance evaluation systems, and the Marine aviator career track. Chapter III reviews the study of past military officer promotion research, highlighting the uniqueness of the current study. Chapter IV begins the quantitative portion of the study, detailing the two independent data sources (TFDW and MMSB) and explains the coding, cleaning, and aggregation of the final study dataset. Chapter V introduces the study's dependent and explanatory variables, and hypothesizes the expected signs of the variables in later regression analysis. Chapter VI is a preliminary analysis of the study's promotion dataset sample through descriptive statistics. Chapter VII introduces the regression models and estimation techniques for detailed statistical analysis of the research questions and hypotheses. Chapter VIII presents the statistical results of the regression models. Chapter IX integrates the statistical findings of the study with the qualitative aspects of Marine officer promotion policy, performance evaluation, and the sponsor's concern in long-term impacts on the aviation officer corps. The research concludes with recommendation to the study's sponsor regarding an effective use of the promotion system in maintaining the best interest of the long-term Marine officer corps, and the aviation occupational field specifically, through an appropriate distribution of technical and tactical experience among the lieutenant colonel rank.

II. MARINE AVIATION AND PROMOTION

A. INTRODUCTION

"Every Marine a rifleman" is an ethos of longstanding and a deeply held tradition in the Marine Corps. This ethos is in part what makes the Marine Corps unique from the other military services. All Marine officers, regardless of MOS, begin their training at The Basic School (TBS), in Quantico, Virginia. The emphasis of this first stage of officer training is on ground tactics in employing an infantry platoon in combat. The training is approximately six months long and provides the officer corps with an infantry-first perspective; all other components of the Marine Corps support this primary element. Additionally, a Marine's performance at TBS (as measured by class ordinal standing) carries forward throughout his career, affecting the timing of promotion eligibility by way of the Lineal Control Number (LCN) system of precedence.

This chapter provides the information on Marine aviation, aviator career structure, and the USMC officer promotion and performance evaluation systems. This information provides background needed to understand the context of the study's research problem.

B. MARINE AVIATION

The Aviation Combat Element (ACE) is an integral component of the Marine Air-Ground Task Force (MAGTF), which is the principal *warfighting* organization of the Marine Corps. Marine aviation performs six vital functions that directly support the MAGTF in the prosecution of combat operations across all levels of war:

- Offensive Air Support (OAS)
- Anti-Air Warfare
- Assault Support
- Air Reconnaissance
- Electronic Warfare
- Control of Aircraft and Missiles

The context of this thesis includes the officer manpower elements of the first five aviation functions; “Control of Aircraft and Missiles” is not included in the study. The manpower of the first five functions of aviation is composed of Marine Corps officers who are designated naval aviators and Naval Flight Officers (NFO). The term “aviator” is synonymous within the study for both designated naval aviators and NFOs, unless otherwise explicitly made distinct.

1. Marine Aviation Organization

The organization and structure of Marine aviation begins with the Marine Aircraft Wing (MAW). Figure 1 depicts a notional MAW, which is composed of Marine Wing Support Groups (MWSG), Marine Air Control Groups (MACG), and Marine Aircraft Groups (MAG). MAGs are further organized into flying squadrons where the bulk of Marine aviators reside and operate.

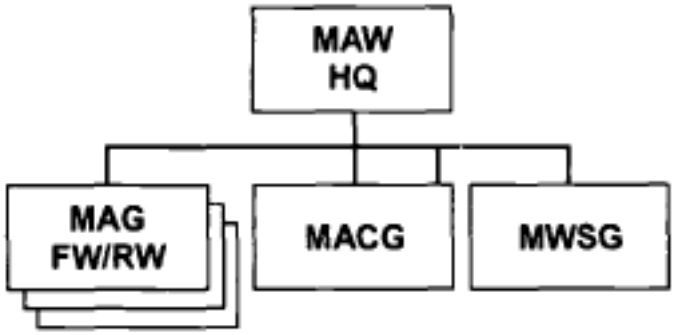


Figure 1. Marine Aviation Organization (from: MCWP 3-2, Aviation Operations)

Flying squadrons are organized by aircraft type, model, and series (T/M/S), which are designated as such based on the roles and functions performed within the larger Marine aviation context. Squadron types beginning with “V” operate fixed-wing aircraft types (VMA, VMFA, and VMGR) and squadrons beginning with “H” operate rotary-wing aircraft (HMM, HMH, HMLA). Figure 2 depicts Marine aviation’s flying squadron organizations by aircraft type and model. The tilt rotor MV-22 aircraft (VMM) and its aviators are considered rotary-wing for the purpose of study categorization.

Squadron Type	Aircraft Type	# of Squadrons[1]	# of Primary Aircraft Authorized[2]
VMA	AV-8B	7	16
VMFA	F/A-18A/C	12	12
VMFA (AW)	F/A-18D	6	12
VMAQ	EA-6B	4	5
VMGR	KC-130	5	12
VMAT	AV-8 Training	1	30
VMFAT	F/A-18 Training	1	12 F/A-18A/C 17 F/A-18D
VMFT	Aggressor Squadron F-5	1	11 F-5E 1 F-5F
VMGRT	KC-130 Training	1	8
VMU	UAV	2	5
HMH	CH-53E	6	16
HMH[3]	CH-53D	5	8
HMM	CH-46E	18	12
HMLA	UH-1N AH-1W	10	9 UH-1N 12 AH-1W
HMT HMMT(T)	Helicopter Training	HMM(T) 1 CH-46E 1 CH-53E 1 CH-53D 1 UH-1N/AH-1W	18 CH-46E 15 CH-53E 6 CH-53D 14 UH-1N 20 AH-1W
VMM	MV-22	TBD	12
VMMT	MV-22 Training	1	TBD

[1] The total number of squadrons, including reserve units.

[2] The primary aircraft authorization for each squadron is a fixed number. However, the actual number of aircraft in a squadron varies based on production timelines, scheduled depot-level maintenance cycles, aircraft transfers, etc.

[3] Although CH-53D squadrons have retained their HMH designation, they are considered medium lift like a CH-46E squadron, instead of heavy lift like a CH-53E squadron.

Figure 2. Marine Flying Squadrons & Aircraft Type/Model (from: MCWP 3-2)

2. Marine Aviation Manpower

The aviator MOS is specifically tailored to fill the manpower requirements of the tactical flying squadrons. Aviators are assigned to squadron types based on Primary Military Occupational Specialty (PMOS) designation, which is linked to the qualification of operating a specific T/M/S aircraft. Table 1 lists the Marine aviator PMOSs and associated aircraft T/M/S that are analyzed for promotion effects within the study.

Table 1. Aviator PMOS & Aircraft T/M/S (*Indicates NFO)

Aviation PMOS	Aircraft T/M/S
7509	AV-8B Harrier
7518	F-35 Joint Strike Fighter
7523	F/A-18A/C Hornet
7525*	F/A-18D Hornet
7532	MV-22
7543	EA-6B Prowler
7556/7557	KC-130 F/R/T/J Hercules
7562	CH-46E Sea Knight
7563	UH-1N Huey
7564	CH-53D Sea Stallion
7565	AH-1W Cobra
7566	CH-53E Super Stallion
7588*	EA-6B Prowler

Note: F-35 (7518) is not included in promotion effects analysis.

3. Marine Aviator Career Structure

The typical Marine aviator career structure is explained in the following section. The explanation begins at commissioning and continues to the point of promotion eligible for O-5. Not all career tracks and opportunities are discussed because of the wide variety in options.

a. Flight School and T/M/S Selection

Marine aviators begin their flying careers as Student Naval Aviators (SNA) or Student NFOs (SNFO) at primary flight training conducted directly by the U.S.

Navy or through an exchange program with the U.S. Air Force. SNAs are trained to operate aircraft as pilots, directly manipulating the airplane's controls and flight surfaces from takeoff to landing. SNFOs receive limited exposure to manipulating the aircraft in flight; however, their training is primarily concerned with navigation and operation of aircraft systems (weapons and electronics).

At the conclusion of primary flight training, Marine SNAs are selected to one of four aircraft-type career tracks: fixed-wing tactical jets, fixed-wing maritime, rotary-wing, or tilt-rotor. Table 2 depicts the aircraft-type career tracks and associated aircraft T/M/Ss. SNFOs are selected directly into one of two T/M/S career tracks, F/A-18 or EA-6B. After primary selection, SNAs complete the intermediate and advanced flight training syllabi of their specific aircraft-type. Upon completion of U.S. Navy advanced flight training, SNAs and SNFOs are "winged" as naval aviators and NFOs respectively. SNAs are also selected at this time into their specific T/M/S aircraft, unless already assigned by default in either the maritime or the tilt-rotor type tracks.

Table 2. Aircraft-Type Career Track Selection & T/MS

Aircraft-Type Career Track	**Aircraft T/M/S**
Fixed-wing Tactical Jet	F/A-18, F-35, AV-8B, EA-6B
Fixed-wing Maritime	KC-130
Rotary-wing	CH-46, CH-53, UH-1, AH-1
Tilt-rotor	MV-22

b. Initial Squadron and PMOS Assignment

After completing U.S. Navy flight training, Marine aviators return to the Marine Corps proper and enter the Fleet Replacement Squadron (FRS), which is a training squadron specific to the T/M/S aircraft selected at flight school. From this time forward, a Marine aviator's flying career is dictated by the USMC Aviation Training and Readiness program (T&R), which is specific to each T/M/S aircraft. The T&R dictates

aircraft and mission training, qualifications, and designations. The T&R program divides Marine aviation training and readiness into four phases: Core Skills Introduction (CSI, 1000 phase), Core Skills (CS, 2000 phase), Mission Skills (MS, 3000 phase), and Core Plus Skills (CPS, 4000 phase). Figure 3 shows the aviation T&R phases with respect to a notional timeline in squadron months. Each aircraft T/M/S community has their own T&R with timelines and training/readiness events specific to its own aircraft and nature of missions within the six-function construct of Marine aviation.

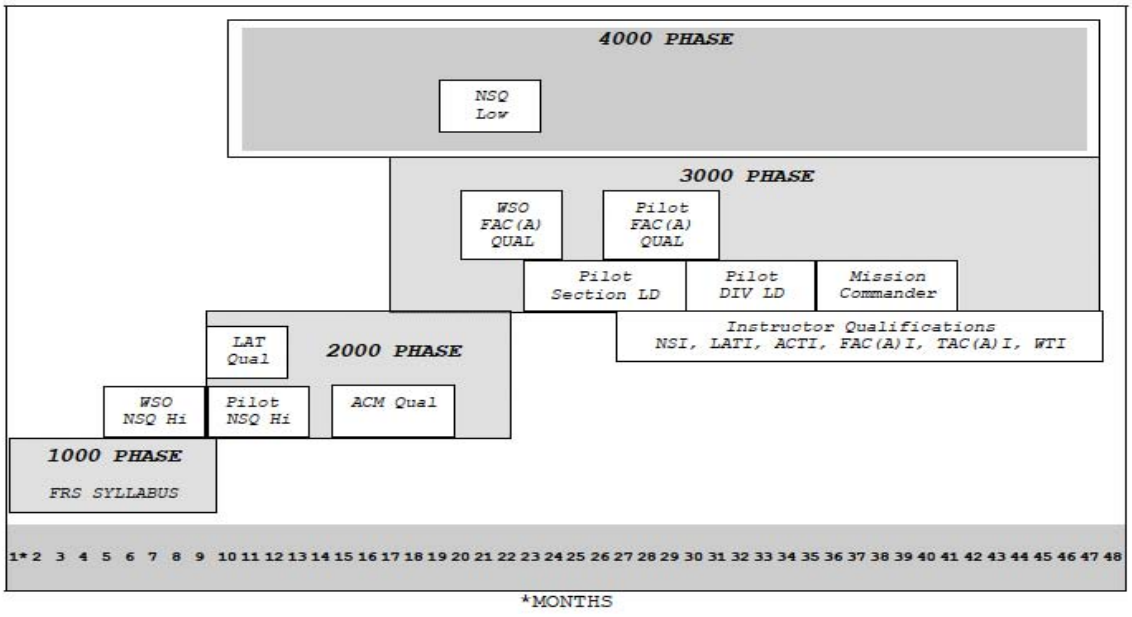


Figure 3. Notional T/M/S T&R Progression (from : NAVMC 3500.14B)

Upon completion of the FRS (CSI or 1000 phase), aviators are assigned their T/M/S PMOS indicative of their basic qualification in that aircraft. Additionally, aviators are assigned their first operational assignment and flying squadron. Aviators train and operate in the squadron along the notional T&R progression in Figure 3. Each Marine aviator progresses though the T&R at a unique pace, coincident with squadron operations and deployment cycle, aircraft availability, weather, and personal motivation and aptitude. As such, there is no defined T&R culmination point for the first 3-year operational assignment for aviators. Some finish their first assignment ahead of their

peers (deep into the 3000 phase), on par with their peer group (early 3000 phase), or below (2000 phase). Each T/M/S community determines their "average" in T&R progression.

c. Career Level School / B-Billet Assignment

Most aviators finish their first operational squadron assignment somewhere within the MS phase (3000) of the T&R, having gained PMOS proficiency, credibility, and deployment experience. Marine officer career counselors often suggest resident Professional Military Education (PME) or B-billet assignments to aviators who have finished their initial flying assignment. PME at the Expeditionary Warfare School (EWS), or a B-billet assignment as a Forward Air Controller (FAC, MOS 7502) with an infantry unit, is encouraged as a career enhancement assignment in giving aviators valuable Marine Corps experience vice more "time-in-the-cockpit."

d. Second Squadron Assignment

Upon completion of an initial three-year flying assignment, or an "out-of-the-cockpit" tour in PME or B-billet, aviators are encouraged to return to the flying squadron in order to continue their T&R progression. The second PMOS operational assignment is usually experienced by senior captains (grade O-3) and includes upper level T&R proficiency achievement in the MS and CPS phases (3000 & 4000 levels). Additionally, aviators at this career point are usually given an opportunity to become instructors in a specific mission set, or several mission sets. The aviators with the highest aptitude and professional reputation are given the opportunity to become Weapons and Tactics Instructors (WTI) or NATOPS Instructors.[3] The WTI designation also entails the achievement of an additional MOS (7577). Another option commensurate with the second operational flying tour is the Aviation Safety Officer billet and additional MOS (ASO, 7596).

[3] The Naval Air Training and Operational Procedures Standardization (NATOPS) is a U.S. Navy sponsored program ancillary to the USMC's T&R program, detailing the "hands-on" procedural aspects of flying the T/M/S aircraft.

e. Squadron Department Head and Leadership

Upon promotion to the rank of major (grade O-4), Marine aviators are encouraged to return to the flying squadron to assume a leadership billet as a department head or Detachment Officer in Charge (OIC). The squadron Operations Officer (OpsO) and Maintenance Officer (MO) are considered department head billets, and are the principal leadership positions under the squadron commander. These billets are more staff-oriented than operational flying. Squadron majors are still viable operators in their T/M/S aircraft; however, they split their professional time between flying and ground responsibilities. Though all squadron aviators, at every rank, are given ground collateral duties, the squadron ground billets as O-4s are usually much more rigorous.

Another squadron leadership position available to O-4s is that of Detachment Officer in Charge (Det OIC). Det OICs deploy or operate away from the home squadron with less than a full squadron in equipment and personnel. The Det OIC is a mini-commander of a contingent of Marines and aircraft for a specific and limited purpose or mission.

f. Intermediate Level School / B-Billet Assignment

Completion of a squadron department head billet and/or Det OIC assignment signals the colloquial accomplishment of MOS-specific experience for the next grade (O-5) and responsibility level. Aviators are encouraged to conclude their time as O-4s with the next level of PME (Intermediate Level School), another B-billet assignment, or an upper-level staff position at the Marine Expeditionary Force (MEF) level or higher. The accomplishments of the individual aviator by this time in PMOS proficiency with respect to the T&R, professional experience (i.e., deployments, leadership, etc), and performance evaluations, will determine the probability of promotion to the next rank of lieutenant colonel (O-5).

C. USMC OFFICER PROMOTION SYSTEM

The Marine officer promotion system is directed by policy within the Marine Corps Promotion Manual Volume 1, Officer Promotions (MCO 1400.31C). Statutory law under Title 10 regulates Marine officer promotions, with oversight provided by the Secretary of the Navy (SecNav), and Secretary of Defense (SecDef). The selection standard ethic of Marine Corps officer promotions is "best and most qualified" among the eligible candidates (MCO 1400.31C, 2006, p. 3–9).

1. Promotion Categories

The Commandant of the Marine Corps (CMC) is delegated authority from the SecNav to promote officers from within competitive categories of related skills or experience levels. CMC divides promotion eligible officers into five separate categories:

- Unrestricted Officers
- Restricted Officer (Limited Duty Officer)
- Warrant Officers / Chief Warrant Officers
- Active Reserve Officers
- Specialist Officers

The vast majorities of regular commissioned and active duty Marine officers, from the ranks of captain through colonel (O-3 through O-6), are promoted from within the unrestricted competitive category. The "unrestricted" aspect of this category indicates that Marine officers from all occupational fields compete against each other for promotion vacancies specifically allocated to this category. Specific to the study's research focus, aviators are placed within the unrestricted competitive category, and thus compete against all other unrestricted officers of various occupational fields (infantry, logistics, artillery, and intelligence) for promotion selection.

2. Promotion Zones

The unrestricted competitive category is further organized into promotion zones based on officer seniority. Seniority is established and maintained by the lineal

precedence number (LCN) system. The LCN is based on grade, date of rank, and class standing at The Basic School (TBS). Marine second lieutenants that begin a TBS class together most likely share the same date of rank, and would otherwise share the same exact level of seniority for the rest of their careers without any other measure of differentiation. Therefore, the overall ordinal standing in TBS class performance further defines seniority among those officers who begin their Marine Corps officer careers together. Those Marine officers who finish at the top of their TBS class will always have LCN seniority over their classmates who finished below them, given that they continue to progress through the officer ranks together.

Promotion zones are divided into three categories: above-zone, in-zone, and below-zone. The above-zone category represents those officers that have been previously considered for promotion to the next rank but were non-selected. In-zone candidates have not been previously considered for promotion, and their LCNs fall within the defined in-zone limits of that year's promotion board. In-zone for promotion officers represent the primary eligible population for promotion selection to the next rank based on time-in-grade. Below-zone candidates are junior in seniority to the most junior officer of the in-zone category. The below-zone officer cohort represents a general construct of the following year's in-zone population. Above-zone and in-zone candidates incur a failure of selection if not selected for promotion, whereas below-zone candidates do not.

3. Promotion Boards

Officer promotion boards are specifically constructed to consider a single rank for promotion from a particular competitive category. Boards are composed of officers appointed by name who are senior in rank/grade to the promotion selection rank under consideration; i.e., colonels (O-6) and above preside of lieutenant colonel (O-5) selection boards. These Marine officers function as the sole authority in promotion selection. Other officers and enlisted Marines of junior rank are also appointed to the board, but function as recorders and administrative assistants only, and do not perform any promotion selection function. Additionally, promotion boards convene and consider promotion selectees for the *next* fiscal year. For instance, the fiscal year 2012 active duty lieutenant

colonel promotion board ("FY12 USMC LtCol Promotion Board") convened in August 2010 in order to select current O-4s to the grade of O-5 for fiscal year 2012 promotions. Those O-4s selected by the board to O-5 will begin being promoted, based on LCN seniority, in October of 2012.

4. Promotion Information Dissemination

Marine Corps promotion information, to include zones, convening dates, candidate's service records, and board direction and composition, is disseminated through official channels in standardized formats. The process begins with the announcement of upcoming FY promotion selection boards, by rank/grade, in a MARADMIN, which is a Marine Corps administrative announcement in official naval message traffic format. This promotion board convening MARDMIN details the rank/grade of selection consideration by promotion zones. The promotion zones are described by the name, rank, and LCN of the senior and junior officers in-zone, and the junior officer below-zone. From this information, the above-zone construct is inferred as those officers in the current rank/grade with LCNs senior to the senior officer of the in-zone population. As an example, Figure 4 shows the USMC unrestricted lieutenant colonel promotion zones for the FY2012 board (MARADMIN 360/10).

```
B.  LIEUTENANT COLONEL PROMOTION SELECTION BOARD
    SENIOR OFFICER IN-ZONE -      MAJ KISHA M. FLAGG
                                  DOR 1 SEP 05
                                  LCN 10160000
    JUNIOR OFFICER IN-ZONE -      MAJ JEFFREY S. POOL
                                  DOR 1 AUG 06
                                  LCN 10991000
    JUNIOR OFFICER BELOW-ZONE -   MAJ KIRK M. SPANGENBERG
                                  DOR 1 JUL 07
                                  LCN 11871000
```

Figure 4. FY12 O-5 Promotion Zones (from: MARADMIN 360/10).

The promotion board is officially convened with a precept, or letter, from the SecNav to the designated president of the board (i.e., the senior Marine officer of the promotion board), which details the board composition by name, rank, and function. Additionally, the SecNav precept reminds the board of the overriding standard for

promotion selection, that being "best and most qualified," and the number of authorized selections.[4] Despite the selection standard reminder, the SecNav also details "skill guidance" within the promotion board precept. The skill guidance component lists PMOSs that are "critically short" in manpower requirements for the given rank/grade. The skill guidance is not arbitrary, but rather an objective measure of the difference between manpower requirements and current inventory. Furthermore, the skill guidance lists the PMOSs to be given due consideration and the number of officers short (or percentage short) for a given rank. Figure 5 shows an excerpt from the FY2012 promotion board precept regarding skill guidance in critically short MOSs.

d. Skill Guidance. Within this board's charter to select those officers who are "best and fully qualified," the board shall give due consideration to the needs of the Marine Corps for officers with particular skills. At this time, the needs of the Marine Corps reflect a critical shortage of officers in the grade of lieutenant colonel in the following skill areas:

MOS	SKILL	PERCENTAGE SHORT OF REQUIREMENT
0180	Adjutant	34%
3404	Financial Management	10%
5803	Military Police	28%
6002	Aircraft Maintenance	50%

Figure 5. Skill Guidance (from: FY12 USMC LtCol Precept)

The promotion board is required to be equitable and objective in selecting the "best and most qualified" from the eligible population. In order to standardize the objective aspect of promotion selection, Marine Corps policy directs the board to use only the eligible officers' Official Military Personnel Files (OMPF) in considering qualification and merit. The OMPFs of Marines are maintained by Headquarters Marine Corps (HQMC), and updated as new information, qualifications, or performance evaluations arrive. The records are vetted for accuracy by HQMC and organized into a standardized format. Individual Marines have access to their OMPFs in order to ensure

[4] The number of authorized selections is presented as a percentage of the number of eligible officers (e.g., 73% of above/in/below-zone eligible). The number of eligible officers is derived from the Marine Corps' five-year promotion plan document, updated yearly, which formulates the projected promotion eligible cohorts and promotion zones.

that information and records are properly annotated. The Master Brief Sheet (MBS) is a component of the OMPF, which summarizes the Marine's service, qualifications, and performance specifically for promotion board perusal.

The actual proceedings of a promotion board are considered private, and all board members take an oath of disclosure at the board's convening. The oath binds the board member to provide impartial selection/non-selection input, and to not disclose the selection screening of individual officers to anyone outside of the board. Figure 6 shows the standard oath given to promotion board members as listed within the precept.

> The following oath or affirmation shall then be administered by the recorder to each member of the board:
>
> "Do you solemnly swear (or affirm) that you will perform your duties as a member of this board without prejudice or partiality, having in view both the special fitness of officers and the efficiency of the Naval Service and, further, that you will not disclose the proceedings or recommendations thereof pertaining to the selection or nonselection of individual officers except as authorized or required by the Secretary of the Navy or higher authority, so help you God?"

Figure 6. Promotion Board Member Oath (from: FY12 USMC LtCol Precept)

The results of the promotion selection board, however, are divulged publicly in two formats: promotion board statistical results and the by-name selection message. The statistical results usually precede the by-name selection message. The statistical results report presents the promotion board's deliberations with regard to the quantity of eligible and selected officers by promotion zone, and reiterates this information in statistical distributions by race, gender, education level, commissioning source, and MOS. As an example, Figure 7 shows the selection breakdown by race and gender from the FY2011 lieutenant colonel promotion board.

RACE/ETHNIC PROFILE DATA FOR THE FY11 PROMOTION BOARD -- IPZ

	FEMALE			MALE			TOTAL FEMALE and MALE		
	CON	SEL	%SEL	CON	SEL	%SEL	CON	SEL	%SEL
White	9	6	66.7	281	188	66.9	290	194	66.9
Black	0	0	0.0	22	11	50.0	22	11	50.0
Hispanic	0	0	0.0	24	19	79.2	24	19	79.2
Asian/Pac	1	0	0.0	19	11	57.9	20	11	55.0
Amer. Ind	0	0	0.0	3	1	33.3	3	1	33.3
Other	0	0	0.0	3	1	33.3	3	1	33.3
Total	10	6	60.0	353	232	65.7	363	238	65.6

Figure 7. Excerpt from Promotion Selection Statistical Results (from: FY11 LtCol Board)

The by-name promotion selection results are broadcast in an All Navy (ALNAV) official message. The format of the selection message is simply the selected and named officers in alphabetical order, with selection number and unit identifier code. This format is shown in Figure 8, which is an excerpt from the FY2012 USMC lieutenant colonel selection message (ALNAV 080/10).[5] The officers non-selected for promotion are not broadcast in a public format. Those by-name officers not selected for promotion have to be inferred from the initial promotion zone announcement and ALNAV selected messages.

ALNAV 080/10
MSGID/GENADMIN/SECNAV WASHINGTON DC/DEC/-/

SUBJ/FY12 U.S. MARINE CORPS LIEUTENANT COLONEL SELECTIONS//

RMKS/1. I AM PLEASED TO ANNOUNCE THAT THE FOLLOWING NAMED OFFICERS ON THE ACTIVE-DUTY LIST OF THE MARINE CORPS HAVE BEEN SELECTED FOR PROMOTION TO LIEUTENANT COLONEL:
(FOR PROPER ORDER READ LEFT TO RIGHT)

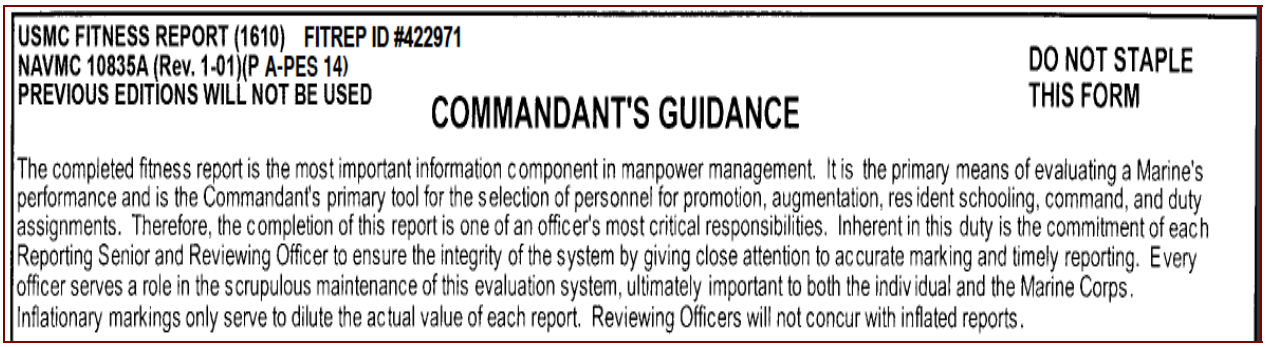
SEL#	NAME		MCC	SEL#	NAME		MCC
216	ADAMS	CW	110	278	ADAMS	JB	QAQ
258	AGRES	JS	1GD	213	ALBANO	AP	036
243	ANDERSON	JJ	233	263	ANDERSON	KC	J64
223	ANDERSON	RL	1FA	5	ARBOGAST	EM	1F1
183	ATHERALL	JJ	902	315	ATKINSON	TA	T9B
272	BACHMANN	JT	G9J	322	BAGGS	A	V6B
120	BANGO	AJ	1GS	85	BANNING	DM	J66
75	BARRIGER	SK	NC3	259	BARRY	JC	1QJ
35	BASCO	SM	1TV	50	BELTRAN	SB	1NE
295	BERNTH	BD	QAS	271	BISHOP	JW	1NF

Figure 8. Excerpt (from the FY12 USMC LtCol Promotion Selection)

[5] Selection number: the promotion board counts each selection in lineal precedence order beginning with the most senior selected officer to the most junior; i.e., the most senior officer selected is selection number one.

D. PERFORMANCE EVALUATION SYSTEM

Promotion selection and individual performance are inextricably linked according to Marine Corps promotion policy and performance directives. The officer promotion selection standard is the "best and most fully qualified" from the competitive category under consideration. Additionally, as shown in Figure 9, the Marine Corps Performance Evaluation System (PES) is the primary venue for evaluating individual performance and acts as the primary tool for promotion selection determination.[6] Thus, promotion selection in the Marine Corps is primarily achieved by the merit of an individual's past service performance. The quality of past service performance is the litmus test for additional responsibility in increased rank.



USMC FITNESS REPORT (1610) FITREP ID #422971
NAVMC 10835A (Rev. 1-01)(P A-PES 14)
PREVIOUS EDITIONS WILL NOT BE USED

DO NOT STAPLE
THIS FORM

COMMANDANT'S GUIDANCE

The completed fitness report is the most important information component in manpower management. It is the primary means of evaluating a Marine's performance and is the Commandant's primary tool for the selection of personnel for promotion, augmentation, resident schooling, command, and duty assignments. Therefore, the completion of this report is one of an officer's most critical responsibilities. Inherent in this duty is the commitment of each Reporting Senior and Reviewing Officer to ensure the integrity of the system by giving close attention to accurate marking and timely reporting. Every officer serves a role in the scrupulous maintenance of this evaluation system, ultimately important to both the individual and the Marine Corps. Inflationary markings only serve to dilute the actual value of each report. Reviewing Officers will not concur with inflated reports.

Figure 9. Excerpt (from: FITREP Form)

The focus of the following section is to describe the USMC Performance Evaluation System (PES) as it applies to promotion selection opportunity. Specifically, the Marine Corps fitness report (FITREP) will be described along with its presentation in summarized format at promotion selection boards.

1. Fitness Report

The Marine Corps FITREP is the primary tool, in standardized format, for evaluating Marines' service performance. The FITREP describes the by-name Marine

[6] The Performance Evaluation System manual (short title "PES" MCO P1610.7) governs and informs the performance evaluation of U.S. Marines.

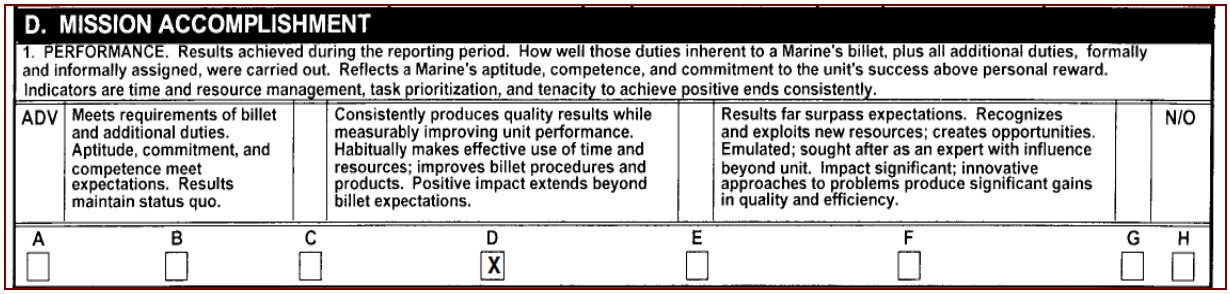
Reported On (MRO) and Reporting Senior (RS) relationship, which is the primary evaluation construct between leader and led, or boss and worker. Also, the FITREP establishes the by-name Reviewing Officer (RO) relationship. The RO is the RS's superior and acts as a second evaluator of the MRO, and to ensure that the FITREP is completed in accordance with the PES Manual and to an equitable evaluative standard. Additionally, the FITREP establishes the named billet that the MRO is assigned for evaluation. The billet is also described in terms of specific responsibilities during the assignment's term or evaluation period. The FITEP lists the specific accomplishments with regard to the listed billet responsibilities that the Marine attained during the evaluation period. Finally, the FITREP lists and details the Marine Corps training and education qualifications accomplished during the reporting period in physical fitness, marksmanship, martial arts, and Professional Military Education (PME).

a. FITREP Grading

RSs grade the performance of the MROs under their responsibility according to 14 standardized FITREP attributes. As shown in Table 3, the attributes are categorized into five distinct performance evaluation sets: mission accomplishment, individual character, leadership, intellect and wisdom, and fulfillment of evaluation responsibilities. Each attribute is graded on a scale of A to H; the first value (A) indicates "adverse" or below standard, whereas the last value (H) indicates "not observed." The middle values describe all scaled performance that meets the standard and above. The "standard" is described qualitatively for each FITREP attribute as shown in Figure 10. The RS is expected to apply this attribute standard to the MRO and grade his performance accordingly.

Table 3. FITREP Attributes & Categories

Mission Accomplishment	
1. Performance	2. Proficiency
Individual Character	
3. Courage	4. Effectiveness Under Stress
5. Initiative	
Leadership	
6. Leading Subordinates	7. Developing Subordinates
8. Setting the Example	9. Ensuring Well-Being of Subordinates
10. Communication Skills	
Intellect & Wisdom	
11. Profession Military Education	12. Decision Making Ability
13. Judgment	
Fulfillment of Evaluation Responsibilities	
14. Evaluations	



D. MISSION ACCOMPLISHMENT

1. PERFORMANCE. Results achieved during the reporting period. How well those duties inherent to a Marine's billet, plus all additional duties, formally and informally assigned, were carried out. Reflects a Marine's aptitude, competence, and commitment to the unit's success above personal reward. Indicators are time and resource management, task prioritization, and tenacity to achieve positive ends consistently.

ADV				N/O
	Meets requirements of billet and additional duties. Aptitude, commitment, and competence meet expectations. Results maintain status quo.	Consistently produces quality results while measurably improving unit performance. Habitually makes effective use of time and resources; improves billet procedures and products. Positive impact extends beyond billet expectations.	Results far surpass expectations. Recognizes and exploits new resources; creates opportunities. Emulated; sought after as an expert with influence beyond unit. Impact significant; innovative approaches to problems produce significant gains in quality and efficiency.	

A	B	C	D	E	F	G	H
☐	☐	☐	☒	☐	☐	☐	☐

Figure 10. "Performance" (from FITREP Attribute Qualitative Standard)

The RO performs an evaluative function of the MRO as well in the comparative assessment. In the comparative assessment, the RO places the MRO in a qualitative category compared to all other MROs that the RO has evaluated of the same rank/grade. The RO's comparative assessment, as shown in Figure 11, is known in

colloquial terms as the “Christmas tree” for its shape, which describes the narrowing in population of those Marines expected to fill the upper categories of comparative performance as opposed to the lower.

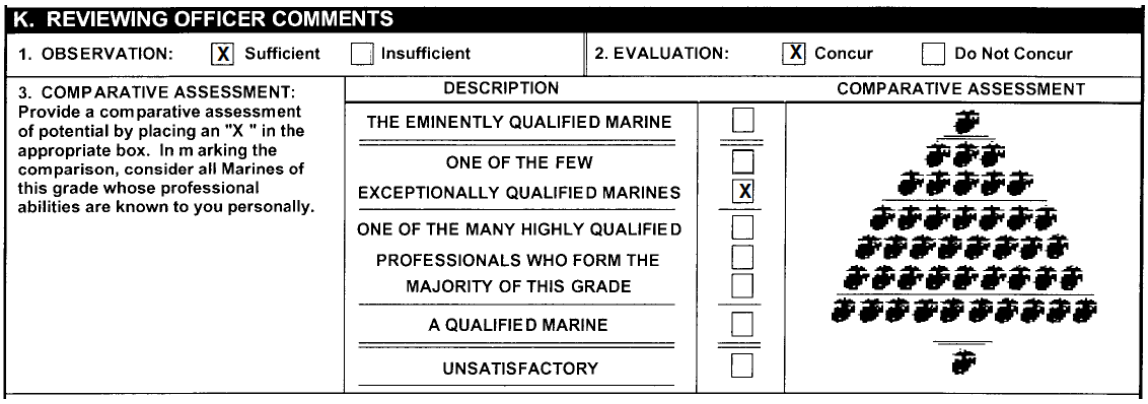


Figure 11. RO’s Comparative Assessment (from: FITREP Attribute Qualitative Standard)

b. Presentation of Aggregate Relative Performance

The performance grades of FITREP attributes and comparative assessment are aggregated into summarized formats for ease of comparison between Marines in overall performance. Marines’ individual performance is presented to promotion selection boards in the form of the Master Brief Sheet (MBS) component of the OMPF. The MBS summarizes performance in the following manner.

The RS’s attribute grades of the MRO are aggregated into an overall report average grade, which is based on a 4.0 scale. The individual report average is then normalized with the RS’s overall average grading of all other MROs of the same rank/grade into a Cumulative Relative Value (RV). The RV is expressed on an 80.0 to 100.0 normal distribution scale, as shown in Figure 12. An RV of 90.0 indicates that the MRO was the RS’s median performer, whereas 80.0 and 100.0 indicate the lowest and highest performer, respectively. The RV allows objective performance comparison between MROs of different RSs. RV performance is further condensed into categorical representations, or strata’s, of RV. The upper strata (or “third”) represents an RV of 93.34 to 100.0, the middle strata 86.67 to 93.33, and the lower 80.0 to 86.66.

The RO's comparative assessment mark is adjusted for comparison with other MROs by tabulating the amount of graded Marines of the same rank that were marked above, with, and below the subject MRO with respect to the "Christmas tree." There is no true "normalization" of the RO's marks for comparison with MROs of other ROs.

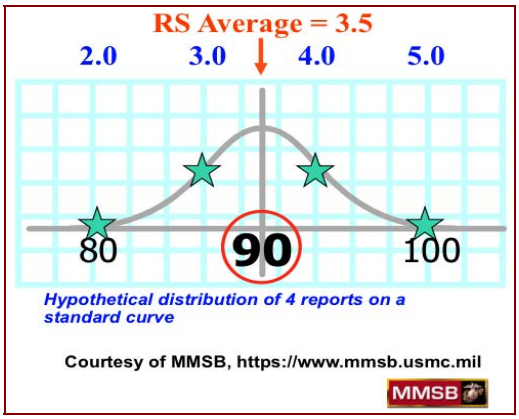


Figure 12. FITREP Relative Value (RV) (from MMSB)

A Marine officer's FITREP RVs and comparative assessment marks are summarized and condensed in the MBS for quick review by the promotion board for selection decisions. Figures 13 and 14 show the MBS presentation of a notional MRO's FITREP marks by the RS and RO. The text's use of "RV" is shown in the "Cum RV" column of the RS markings example in Figure 13.

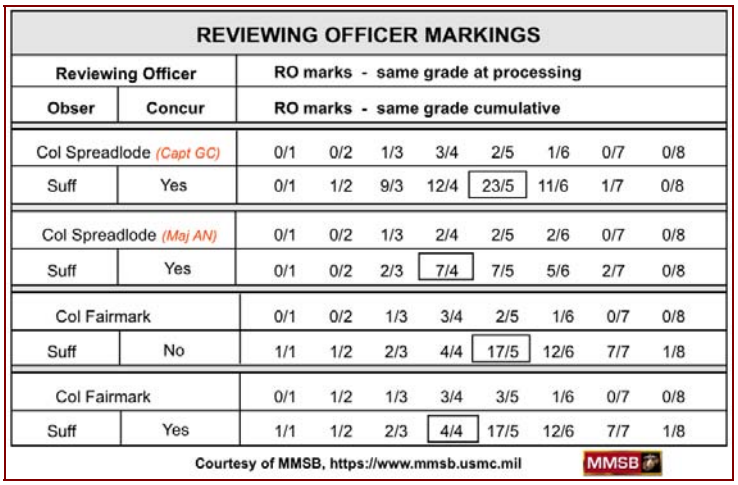
REPORTING SENIOR MARKINGS

Reporting Senior	Per	Pro	Cou	Eff	Ini	Lea	Dev	Set	Ens	Co	PME	Dec	Jud	Eval
LtCol Stickler	C	C	B	B	C	C	B	C	C	B	B	B	C	H
LtCol Smidgen	C	C	C	H	C	C	H	C	H	B	H	C	C	H
LtCol Highmark	D	F	E	C	E	E	D	D	D	D	D	E	E	H
LtCol Solo	B	B	C	B	B	C	B	B	C	B	B	C	B	H

Promote	Reports	RPT Avg	RS Avg	RS High	RPT at High	RV at Proc	Cum RV
Yes	14 of 17	2.53	2.25	2.82	1	94.60	96.00
Yes	8 of 8	2.88	2.93	3.50	1	89.76	89.76
Yes	11 of 16	4.46	5.95	6.38	2	83.70	81.89
Yes	1 of 1	2.30	2.30	2.30	1	NA	NA

Courtesy of MMSB, https://www.mmsb.usmc.mil MMSB

Figure 13. MBS Presentation of RS RV (from: MMSB)

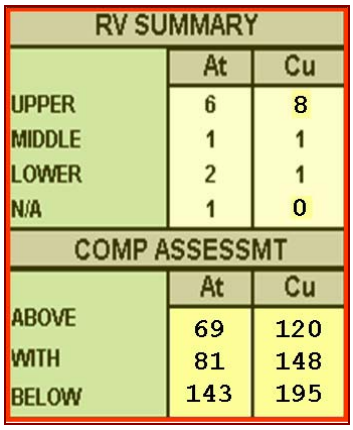


REVIEWING OFFICER MARKINGS									
Reviewing Officer		RO marks - same grade at processing							
Obser	Concur	RO marks - same grade cumulative							
Col Spreadlode *(Capt GC)*		0/1	0/2	1/3	3/4	2/5	1/6	0/7	0/8
Suff	Yes	0/1	1/2	9/3	12/4	23/5	11/6	1/7	0/8
Col Spreadlode *(Maj AN)*		0/1	0/2	1/3	2/4	2/5	2/6	0/7	0/8
Suff	Yes	0/1	0/2	2/3	7/4	7/5	5/6	2/7	0/8
Col Fairmark		0/1	0/2	1/3	3/4	2/5	1/6	0/7	0/8
Suff	No	1/1	1/2	2/3	4/4	17/5	12/6	7/7	1/8
Col Fairmark		0/1	1/2	1/3	3/4	3/5	1/6	0/7	0/8
Suff	Yes	1/1	1/2	2/3	4/4	17/5	12/6	7/7	1/8

Courtesy of MMSB, https://www.mmsb.usmc.mil MMSB

Figure 14. MBS Presentation of RO Comparative Assessment

The MBS presentation of RS and RO grades are further tabulated for even quicker review and comparison by promotion selection boards. A Marine's performance history is tabulated into the number of reports that fall into each of the RV strata categories. For example, Figure 15 shows that the MRO had eight reports that fell within the upper RV strata, one in the middle, and one in the lower (cumulative, or "CU," column).



RV SUMMARY		
	At	Cu
UPPER	6	8
MIDDLE	1	1
LOWER	2	1
N/A	1	0
COMP ASSESSMT		
	At	Cu
ABOVE	69	120
WITH	81	148
BELOW	143	195

Figure 15. Tabulated RV & Comparative Assessment Marks

The comparative assessment marks are presented as the total of all Marines of the MROs same rank/grade, at the time of evaluation, that the ROs evaluated

and their relative placement on the "Christmas tree." For example, Figure 15 shows that 120 Marines were marked above the MRO by all of his ROs, 148 at the same level, and 195 below the MRO's marks.

c. Aviator Assessment

The final aspect of PES applicability to the study is the directed comments regarding aviator proficiency within the FITREP. The PES construct is conducive to evaluating the performance of all Marines regardless of occupational field or specialty. Aviator's performance as aviators (i.e., flight hours, aircrew qualifications, etc.) is not captured within the 14-attribute FITREP format. The Marine Corps realized this shortcoming of the system when evaluating aviators, and therefore revised the PES in March of 2002 by adding a requirement for RSs of MROs that are designated aviators or NFOs (MCO 1610.7E, Change 3, 29Mar02). RSs are required to make a "directed comment" within Section I of the FITREP regarding flying proficiency of the aviator MRO. Figure 16 shows the excerpt from the PES manual that directs comments in the FITREP regarding aviators and proficiency (MCO P1610.7F, 4-44). Additionally, comments are directed in this section for those aviators subject to reprimand or disciplinary action from a Field Flight Performance Board (FFPB) during the FITREP reporting period.

> (23) In the case of Marine aviators and flight officers, comment on pure flying proficiency and when applicable, in terms of aeronautical leadership, airborne judgment, or use of aeronautical assets. Some examples are: An aircraft commander, flight leader designations, tactical air coordinator (ground and airborne), mission commander, WTI or any other aeronautically designated Marine in a position of tactical leadership.

Figure 16. Aviator Directed Comments (from: PES Chapter 4)

E. SUMMARY

Marine aviation is an integral element of the MAGTF, which is the principal *warfighting* organization of the Marine Corps. The ACE's manpower is composed of Marine Corps officers designated as naval aviators and NFOs that follow a career track

commensurate with officers of other specialties with respect to time-in-grade, performance measurement, and general training requirements (i.e., physical fitness, marksmanship, etc.). However, the aviator career path has its own nuances and challenges particular to flying proficiency as described in the T&R, which does not apply to ground MOSs.

The coupled concepts of “every Marine a rifleman” and selection of the “best and most qualified” from the unrestricted category, encapsulates the Marine officer promotion system. Marines are evaluated for additional responsibility in increased rank by their performance and qualifications as Marines in general, and not as aviation specialists.

The following chapter adds previous academic research into officer promotion and performance evaluation systems to the context of this Marine aviator-specific chapter. Background information on Marine officer promotions and previous academic research into this area provide enough framework to understand the study’s statistical approach to the research problem.

III. LITERATURE REVIEW

A. OVERVIEW

The focus of this study is truly unique in that Marine Corps officer promotions are researched with regard to a single rank and occupational field: lieutenant colonel and aviator. As such, previous research in this narrow area is extremely limited. The literature review criteria thus included USMC officer promotions in general, lieutenant colonel promotions, and other-service aviator promotions and policy. Quantitative, as well as qualitative studies were considered during the literature review in order to acquire a broad perspective of the multiple variables, issues, and implications of this area of study.

B. PROMOTION STUDIES THAT INCLUDE QUANTITATIVE ANALYSIS OF MOS AND OTHER EFFECTS

1. Study by Hoffman (2008)

Hoffman researched the factors in promotion selection for Marine Corps officers to the rank of major, lieutenant colonel, and colonel. Hoffman's primary focus was identifying the factors that provided the greatest predictive power in promotion selection to given ranks. Additionally, Hoffman proffered a new perspective on an existing metric in officer promotion selection criteria. "Reviewing Officer Percentile" effectively normalizes reviewing assessment marks based on an individual reviewing officer's grading trends. Hoffman asserts that the percentile system will give greater clarity into the relative performance of promotion candidates to a selection board.

Hoffman analyzed one lieutenant colonel promotion board, fiscal year 2008, with 519 total observations based on in-zone candidates. A logistic regression model was designed to estimate the binary response probability given discrete values of six categories of variables, holding all other factors fixed. Hoffman's model provided in-depth specification into the factors for promotion to O-5 as he included 40 independent

variables. The categories of variables included basic demographics, commissioning source, performance, occupational field, combat experience, and job assignments. Of particular interest to the present study, Hoffman regressed the effect of the aviator occupational field and found that its coefficient was negative but statistically insignificant in his full model (all 40 independent variables). Hoffman was able to find a statistically significant aviator coefficient, but only when the combat experience and job assignment categorical variables were omitted from the model. Overall, Hoffman's declared "best" lieutenant colonel promotion model touted a Pseudo R-squared of 0.4233, or possessing an explanatory power of 42.3 percent.

2. CNA Study by McHugh et al (2006)

A Center for Naval Analyses (CNA) study, conducted in March of 2006, indirectly explored the effects of MOS and promotion board precept messages on selection for promotion of Marine Corps officers to the rank of major, lieutenant colonel, and colonel. The impetus for the study was to analyze the USMC officer manpower system, with particular emphasis on billet requirements matching and resultant shortages. CNA was asked to provide recommendations based on their statistical findings to the manpower shortages at that time in specific skill fields and PMOSs in the wake of the "long war" in Iraq and Afghanistan.

CNA conducted detailed analysis of how officers are promoted and to some degree, which factors provided the greatest power in predicting the promotion probability. Two particular factors were explored by CNA, the effects of primary military occupational specialty (PMOS) and promotion board precept guidance. CNA collected and analyzed 5,422 observations of "in-zone" lieutenant colonel promotion candidates from 1995 to 2006, along with similar data for the ranks of captain, major, and colonel. Logistic regression revealed that four aviator PMOSs had statistically significant negative effects on probability of promotion to lieutenant colonel.[7] Of note, the CNA analysis showed only nine total PMOSs with statistically significant effects on promotion

[7] CNA derived data of statistically significant aviator PMOSs: 7509 (-8 ppts), 7523 (-9 ppts), 7557 (-25 ppts), and 7564 (-20 ppts), (McHugh et al., 2006, p. 71).

probability; four out of these nine PMOSs were of the aviator variety. Additionally, and with regard to promotion board precept guidance, CNA documented a statistically significant positive effect (+0.06 or 6 ppts) of a suggested occupational field or PMOS in promotion selection. This means that those Marines with MOSs designated as "critical" in promotion board precept guidance are estimated to have higher promotion selection probability than those Marines whose MOSs are not listed as "critical." CNA's finding indicates that negative MOS-effects in promotion probability, such as aviation, can be offset by promotion board guidance in precept messages.

CNA's findings led to both short and long-term recommendations to alleviate chronic MOS shortages. Short-term strategies included reducing B-billet assignments for high demand PMOSs, initiating stop loss, and using reservists to fill MOS gaps. Among the long-term fixes, CNA suggested expanding the use of precept guidance in promotion and command screening boards, since its current use exhibited practical significance in increasing promotion probability for critically short MOSs. Additionally, the CNA researchers acknowledged the existence of other solutions for the Marine manpower system that would be deemed "unlikely to be adopted" by top-level leadership (McHugh et al, 2006, p. 103). One of these "unlikely" options presented by CNA was the concept of promoting officers within a system of expanded competitive categories based on occupational field, and thus abandoning the existent unrestricted officer pool.

3. Study by Perry (2006)

An NPS thesis by Perry in 2006 analyzed the factors for promotion and retention of field grade Marine Corps officers. Perry constructed a survival model for retention factors and performed logistic regression in estimating a promotion model. Perry's promotion sample included Marine O-4 and O-5 candidates, and focused on the effects of PMOS and general occupational field on the probability of selection to the next rank.

Perry compiled over 27,000 observations from the Marine Corps Commissioned Officer Accession Career (MCCOAC) and DMDC Marine officer cohort files from 1980-2001. Perry's specific analysis of lieutenant colonel promotions included cohort data from 1980 to 1988 using 13,374 observations. Perry constructed two O-5 promotion

models with similar specifications, ranging between eight and nine independent variables apiece. The independent variables used to specify Perry's promotion models included gender, marital status, ethnicity, commissioning age, commissioning source, commissioning fiscal year, prior enlisted, Basic School standing, occupational group, and PMOS.

Perry's regression results of the lieutenant colonel promotion model demonstrated a statistically significant promotion bias towards certain PMOSs and occupational fields. Specifically, Perry shows a statistically significant effect of two aviator PMOSs (CH-53E and F/A-18 pilots) in probability of promotion; however, one is negative and the other positive.[8] However, Perry does not find a similar statistically significant effect of the general aviator occupational field in the alternately specified logistic regression model.

4. Study by Ergun (2003)

Ergun's NPS thesis study in 2003 analyzed the effects of commissioning sources on Marine officer career paths, to include the probability of promotion through the field-grade ranks. The researcher's hypothesis was that the more comprehensive a particular accession program is, with regard to time, effort, investment, etc., the greater the positive effect on an officer's career performance measured by retention and promotion.

Ergun drew 5,954 observations on Marine O-5 candidates for promotion between fiscal years 1980 and 1983. Ergun constructed a bivariate probit model to address possible sample selection bias. His first stage probit model estimated survival to the promotion board, and the second estimated promotion probability. Ergun was able to distinguish promotion probability differences between commissioning programs, while controlling for other explanatory variables with his bivariate probit model. The model's specifications included demographics, Basic School class ranking, occupational field, and commissioning source. An important specification missing from the Ergun O-5 promotion model was the individual performance of the candidate officer.

[8] Aviator partial effects at the 0.10 significance level: CH-53E pilot -0.06 (or -6 ppts), and F/A-18 pilot +0.048 (or +4.8 ppts).

Ergun's findings validated his commissioning source hypothesis to some degree, reporting statistically significant effects for certain accession programs (NROTC, PLC, and MECEP). In the process of isolating commissioning source effects, Ergun also uncovered a significant effect for the aviator occupational field. Ergun reported a +0.035 marginal effect for the aviator MOS (or +3.5 ppts) on probability of promotion to O-5, at the 0.10 significance level.

5. Study by Cerman (2005)

An NPS study by Cerman in 2005 examined the effects of a so-called "marriage premium" on USMC field grade promotion probabilities. Cerman combined MCCOAC and fitness report data files of Marine officer cohorts to conduct retention, performance, and promotion analysis of the purposed research question. Cerman's O-5 promotion sample included 2,774 total observations from officer cohorts between 1980 and 1983. The O-5 promotion model included four specification variants based on differing hypotheses regarding the marriage premium. The model controlled for demographics (including detailed marriage/dependent variables), commissioning source, and Basic School class standing. The O-5 promotion model did not control for PMOS or occupational field. Cerman demonstrated a statistically significant (varying significance levels depending on model specification) and positive effect of marriage and dependents on promotion to lieutenant colonel.

6. Study by Branigan (2001)

An NPS study by Branigan in 2001 investigated the effects of graduate education on retention and promotion to lieutenant colonel in the Marine Corps. The hypothesis of the study was that higher education translated into greater probability of promotion to O-5, holding other factors fixed. Branigan analyzed the in-zone candidates of four lieutenant colonel promotion boards (1998–2001) totaling 1,627 observations. The regression analysis of promotion effects involved probit estimation techniques with several explanatory variables including demographics, experience, performance, and occupational field.

Branigan's findings supported the study's main hypothesis that graduate level education had a positive effect on probability of promotion within the sample. Additionally, Branigan controlled for occupational field among his sample with four probit models of various specification. The aviator occupational variable yielded statistically significant (0.01 significance level) and positive coefficients in all of Branigan's probit models. Unfortunately, however, Branigan did not report the marginal effects of the aviator MOS as it was not the key variable of interest in the study.

C. MARINE MANPOWER SYSTEMS ANALYSIS THAT INCLUDES PROMOTION

1. Study by Vasquez and Williams (2001)

Vasquez and Williams performed a qualitative study on the aggregate Marine Corps officer promotion system. The primary research question of their study was whether the current promotion system did an adequate job in providing "the right Marine, at the right place, with the right skills." The researchers entertained a notion of a promotion system by occupational field specialty, instead of generic vacancies by rank from the unrestricted officer pool. The research included a thorough analysis of the promotion histories and policies of the other branches of service compared to the Marine Corps. Their findings in this analysis showed that each branch of the U.S. military selects officers for promotion based on an underlying "value premise" (Vasquez and Williams, 2001, p. 94). The researchers asserted that the Marine Corps might find greater optimality in the overall officer manpower structure with a specialized promotion system.

Vasquez and Williams conclude from their qualitative research that the Marine Corps is not well suited for a promotion by MOS structure. They cite the constraints of statutory law and Marine Corps cultural norms as the most significant reasons for not adjusting the current system. Changing the promotion system would require the Secretary of the Navy to add competitive categories to the Marine promotion system, which could induce a culture shift of specialization rather than the current and effective ethos of "every Marine a rifleman."

2. Study by Jobst and Palmer (2005)

The thesis work of Jobst and Palmer primarily focused on the performance evaluation system (FITREP) of the Marine Corps as it applies to assignment matching and the overall optimum performance of the force. Their focus centered on the notion of "two-sided matching" in maximizing an individual's future performance by matching personal capabilities with skill requirements, and job preference with job availability. Although their research did not specifically address promotion effects, their study's findings and results have implications on the manner in which the Marine Corps evaluates officers for promotion.

The Jobst and Palmer study did include quantitative analysis of the USMC FITREP system. Jobst and Palmer drew from five years (1999-2004) of Official Military Personnel File data for the ranks of second lieutenant through colonel. All told, 33,858 individual officer FITREPs were analyzed with statistical techniques. Their findings revealed that a propensity for higher performance in certain core competencies (14 total) of the FITREP correlated with specific MOSs. Their descriptive statistics findings showed that the average scores within FITREP core competencies varied by MOS, demonstrating from data that certain MOSs have systematic strengths and weaknesses. Unfortunately, the aviator MOS was not analyzed in their research, but suffice it to say the point is adequately made; systematic strengths and weaknesses exist across the spectrum of Marine Corps occupational specialties.

D. SUMMARY

The previous quantitative studies in this literature review have focused on the general factors for promotion such as demographics, performance, operational experience, and occupational field. Many statistically and practically significant effects have been found within their data through regression analysis, to include the effect of occupational field, and to some extent specifics PMOSs. Overall, the findings of past studies that have estimated an "aviation effect" on promotion probability are inconsistent and mixed. The effect of the aviator MOS on promotion to lieutenant colonel is insignificant in Hoffman's study, but significant in Perry and McHugh's. McHugh's

CNA study was conducted in 2006 with multiple years' promotion data current as of 2005, while Hoffman's study only examined promotion data of 2008. Perry's study and findings of split effects between two PMOSs (CH-53E and F/A-18) were based on extremely dated cohort data from the 1980s. Are the statistical differences in "aviator promotion effects" attributed to the nature of the effect or the particular dataset from which it was drawn? Any definitive conclusion on the purposed aviator effect from these studies would be spurious at best. The studies taken in aggregate demonstrate mixed results of an "aviation effect" on promotion probability.

The studies of this literature review also highlight particular deficiencies in the heretofore research in Marine officer promotions and manpower systems. For instance, little effort has been dedicated to isolating the aviator occupational field by the following categories:

- Fixed-wing and rotary-wing communities (over several promotion board years)
- Type/Model/Series aircraft qualifications and designations (T&R Codes)
- Above-zone candidates
- Combat aviator deployments (OIF/OEF/HOA)
- Aviator-specific leadership experience (i.e., squadron department head billets)

Controlling for these additional variables and categories may make a difference in the statistical results of regression analysis.

The common thread among the prior studies is found in their conclusions and recommendations, namely in that most address the debate on promotion effects from within a specialized occupational field versus from within the unrestricted pool. Most studies agree that the Marine Corps officer promotion system performs adequately in providing the right Marine, at the right place and time, even though that is not the explicit goal of promotion board deliberations. Instead, the "best and most qualified" ethic within an unrestricted pool has driven the Marine officer promotion system for several generations, and with great success. Despite this success, however, most studies conclude with an acknowledgment of perhaps an even better method for promotion. In due deference to the other services, and common rationality, the researchers of the

reviewed studies share a common conversation in whether promotion by specialization, to some degree, would be good for the Marine Corps. Promoting by specialization is completely contrary to the Marine Corps culture of "every Marine a rifleman," and thus the basis for the current non-specialized unrestricted category in officer promotions.

Hoffman's research most closely resembles the research conducted in this study. The greatest difference, however, is in the size of his individual promotion board samples, and the number of different samples analyzed. In order to find a statistically significant aviator effect, many promotion boards of the same rank need to be combined for an aggregate effect. Additionally, basic descriptive statistic trend analysis can be leveraged to "tell the story" of aviator promotion opportunities over a period of several years and from within the current operational environment of diverse combat deployments and general economic climate of the present day.

The Jobst and Palmer findings indicate that research is also necessary into the general area of Marine Corps officer occupational field specialization. If systematic strengths and weaknesses are evidenced through data in discrete MOSs, the notion of unrestricted officer pool promotion is compromised. Effectively and indirectly, Jobst and Palmer beg the question, "Is every Marine a Rifleman?" in the sense that performance evaluation of all Marines should not use the same set of metrics housed in the current FITREP system. As the FITREP is the primary indication of past performance for promotion candidates, some MOSs may be at an unfair and systematic disadvantage simply by the current dynamic of "every Marine a rifleman" metrics. Jobst and Palmer conclude that the FITREP system may need an overhaul to account for occupational field-specific metrics. An alternative conclusion, proffered by the researcher of this current study, may be the requirement for a Marine officer promotion system overhaul that selects based on occupational field vacancies rather than from an aggregate officer pool.

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IV. DATA SOURCE AND DESCRIPTION

A. DATA SOURCES

The data used to conduct the statistical analysis of the study's research is drawn from three different sources: Total Force Data Warehouse (TFDW), Marine Manpower Support Branch (MMSB), and Marine Manpower Promotion Branch (MMPR). These data sources were chosen to effectively replicate the composition of promotion selection populations in candidate samples and factors that influence selection to O-5. The exact material used during a promotion board, candidates and their personal Official Military Personnel Files (OMPF), is considered private and restricted only to the designated board. Therefore, any outside analysis of promotion board trends and characteristics is necessarily sample-based, rather than population-based. The study's dataset is original, constructed from raw TFDW and MMSB data, verified by MMPR, and then custom-coded to answer the specific research questions of the sponsor regarding the purported "aviation effect" on promotion to lieutenant colonel.

B. TOTAL FORCE DATA WAREHOUSE

The TFDW dataset is considered the core set of the study; all other data is built around and augments the basic TFDW set. TFDW is used to construct individual promotion board candidate samples by restricting the sample population to only those that were eligible for promotion to O-5 at the time of the promotion board's convening for any given year. The typical lieutenant colonel promotion board convening date within the last decade has occurred between late August and early September. Therefore, multiple "snapshot" TFDW data draws were conducted in close approximation to corresponding FY promotion selection boards. Table 4 provides a detailed list of TFDW "snapshot" dates corresponding to FY promotion boards for study replication purposes. These "snapshot" data draws are key to the construction of the research, as they provide the basic personal information of each O-5 candidate at the time that the actual promotion board reviewed their fitness for the next grade. The qualifications for eligibility of

officers into the study's sample replicates the criteria prescribed by the Marine Corps in O-5 promotion eligibility, and includes the following:

- Active-duty list
- Unrestricted officer category
- Rank of major (grade O-4)
- LCN within the defined promotion zone construct[9]
- Not within 90 days of retirement

Given the satisfaction of the above criteria, the candidate officers and their corresponding personal data housed within the TFDW should accurately reflect those actual officers considered by the board for promotion. After coding, cleaning, and restructuring the raw TFDW dataset, 8,428 total observations were used representing fiscal years 2004–2012 Marine O-4s eligible for promotion to O-5.

Table 4. TFDW Data "Snapshots" & Promo Board Convene Dates

Promotion Board	**TFDW & MMSB "Snapshot" Date**	***Promotion Board Convening Date***
FY2012	31 Jul 10	*17 Aug 10*
FY2011	31 Aug 09	*25 Aug 09*
FY2010	30 Sep 08	*03 Sep 08*
FY2009	30 Sep 07	*05 Sep 07*
FY2008	30 Sep 06	*06 Sep 06*
FY2007	31 Aug 05	*31 Aug 05*
FY2006	30 Sep 04	*08 Sep 04*
FY2005	30 Sep 03	*04 Sep 03*
FY2004	31 Oct 02	*09 Oct 02*

[9] Promotion board zone construction is set forth in an annual MARADMIN convening message that is usually disseminated in July, and is based upon lineal precedence standing.

1. TFDW Dataset Coding, Cleaning, and Structure

The raw data provided by TFDW was not suitable for the current analysis because it included multiple observations per eligible officer. After reconstructing the data so that each observation represents one unique officer, the average population of a single fiscal year promotion board was approximately 1,500 officers[10], which includes above, below, and in-zone eligible O-4s. Table 5 demonstrates the requirement for collapsing the raw data, as the total number of observations for each fiscal year cohort sample does not match the number of unique identifiers, nor the actual number of eligible officers for promotion.

Table 5. Collapsing Initial TFDW Dataset

Promotion Board	**No. of Observations**	**No. of Unique IDs (LCNs)**	***Actual No. Eligible O-4s[11]***
FY2012	4,069	1,571	*1,475*
FY2011	3,396	1,512	*1,409*
FY2010	3,815	1,864	*1,757*
FY2009	2,788	1,571	*1,492*
FY2008	2,404	1,522	*1,451*
FY2007	2,141	1,558	*1,378*
FY2006	1,783	1,456	*1,440*
FY2005	1,371	1,272	*1,306*
FY2004	1,730	1,710	*1,323*
Totals	**23,497**	**14,036**	***13,031***

Additional dataset cleaning and validation was required in order to reconcile the difference between the dataset number of unique identifiers and the actual number of eligible officers described in post-promotion board results. The data provided by TFDW did not consider the O-4s ineligible for promotion for various reasons, such as near

[10] Actual average promotion board size (FY2004-2012) was 1,447 eligible officers.

[11] Actual eligible officer numbers derived from promotion board produced statistical results and includes all three promotion zones (above, in, and below).

retirement and other extraordinary circumstances. Also, the promotion zone construct, with regard to above/in/below zone, provided by TFDW, was consistently skewed across the cohort datasets. The promotion zones were reconstructed with the aid of the official promotion board convening message traffic (MARADMIN) by the Marine Corps, which described the three zones with regard to LCNs of the senior and junior officers in-zone, and the junior officer below zone. With these descriptions based on actual LCNs, the researcher was able to reconstruct the TFDW cohorts to match the actual promotion zones described in the MARADMINs. The TFDW cohort promotion zone reconstruction step was validated for accuracy by crosschecking the senior and junior in-zone officers' name and LCN with the official promotion board convening MARDMIN. Officer name and LCN matching of this sort was considered the litmus test in replicating the actual promotion board zone construct.

Finally, two additional sample exclusion criteria are applied to this study. First, all officers in the below-zone promotion category were dropped from the final dataset because only a single officer was selected for promotion from this category between fiscal years 2004 and 2012. Second, the analysis further excluded Limited Duty Officers (LDO), who compete for their own promotion vacancies separate from the unrestricted category. All told, an additional 5,609 observations were dropped from the initial TFDW dataset after the collapse operation (Table 6), attributed to ineligibility, zone reconstruction, below-zone candidates, and LDOs.

Table 6. Dropping Observations from TFDW dataset

Promotion Board	No. of Observations post-Collapse	Dropped Observations[12]	Resultant Observations
FY2012	1,571	594	977
FY2011	1,512	622	890
FY2010	1,864	726	1,138
FY2009	1,571	559	1,012
FY2008	1,522	500	1,022
FY2007	1,558	598	960
FY2006	1,456	543	913
FY2005	1,272	531	741
FY2004	1,710	935	775
Totals	**14,036**	**5,608**	**8,428**

The final TFDW dataset includes all eligible above and in-zone O-4s for promotion to O-5, representing a very close replication of the actual promotion board cohorts of fiscal years 2004-2012. The resultant total observations in the sample are 8,428, while the actual population of above and in-zone eligible officers over the same period are 8,740. The distribution comparison between the TFDW sample and the actual population is further described in Table 7 with respect to above/in-zone eligible officers and selections for promotion. The percentage comparisons presented in Table 7 provides ample evidence that the sample is accurate and representative of the actual eligible population, with the lone exception of above-zone selections. The large discrepancy between the sample and the population's above-zone selections is due to the fact that a significant number of O-4s are considered first-time eligible for promotion even though their lineal numbers are more senior than the official senior in-zone officer. The Marine Corps officer promotion manual reads, "It is common to have officers whose lineal precedence falls within the Above-Zone population, but who are In-Zone officers," because they had not been previously considered for promotion (MCO P1400.31C, 2006,

[12] All officer that were considered ineligible for promotion, "below-zone" by official Marine Corps personnel files, or LDOs, were dropped from the TFDW dataset.

p. 1–15). A quantity of sampled officers, then, who were selected for promotion, and considered above-zone by LCN, end up in the sample's above-zone "selected" category. These officers, however, were actually categorized as "above-zone, not previously considered" and thus placed in the in-zone population category. Therefore, an unnumbered portion of the sample's eligible and selected officers should be considered out of the above-zone and placed in the in-zone category, which partly explains why the sample's in-zone numbers are consistently lower than the population's. Also, the above-zone percentage difference in selection (17.0%, Table 7) is exacerbated by the fact that there are so few total selections in the above-zone population and sample, as compared to the in-zone category. Any difference in selection numbers will appear to have a greater percentage difference because of this numerical disadvantage.

Table 7. Eligible & Selected Comparison, TFDW Sample vs. Population

Promotion Zone	**Sample**	**Population**	**% Difference**
Eligible Officers:			
Above-Zone	4,258	4,431	3.9%
In-Zone	4,170	4,309	3.2%
Total	**8,428**	**8,740**	**3.6%**
Selected Officers:			
Above-Zone	270	224	-17.0%
In-Zone	2,797	2,871	2.6%
Total	**3,067**	**3,095**	**0.9%**

C. MARINE MANPOWER PROMOTION BRANCH

The above zone discrepancy is remedied by validation of the TFDW sample by the Marine Manpower Promotion Branch (MMPR). MMPR is the Marine Corps' official custodian of promotion board records, and the only department that documents "above-zone, not previously considered" for promotion Marines (a.k.a. in-zone). Because of the private nature of promotion board records, MMPR's data is accessed only on a limited basis. The MMPR data is used to modify the TFDW dataset's promotion zone constructs (Table 8).

Table 8. Eligible & Selected Comparison, MMPR Modified Sample vs. Population

Promotion Zone	MMPR Modified Sample	Population	% Difference
Eligible Officers:			
Above-Zone	4,063	4,431	8.3%
In-Zone	4,208	4,309	3.2%
Total	**8,271**	**8,740**	**5.4%**
Selected Officers:			
Above-Zone	220	224	1.8%
In-Zone	2,830	2,871	1.4%
Total	**3,050**	**3,095**	**1.5%**

The MMPR modification to the base dataset initially appears to decrease overall sample accuracy, total eligible officer difference adjusts from 3.6% to 5.4%, and selected officer difference from 0.9% to 1.5%. However, given that the study's later analytical emphasis will be on in-zone promotion behavior and effects, the MMPR modified dataset appears more attractive. The in-zone eligible sample size moves closer to the population's by way of the modification, 4,170 to 4,208 (population of 4,309), and the in-zone selection difference increases in accuracy from 2.6% to 1.4% difference. Most importantly, however, the sample's large quantity of erroneous above-zone selectees moves to the in-zone category (270 to 220). This movement of 50 observations to the in-one category may be critical in later analysis of statistically significant promotion factors.

D. MARINE MANPOWER SUPPORT BRANCH

The Marine Manpower Support Branch (MMSB) is responsible for maintaining the individual performance records and data of Marines, as described in the Performance Evaluation System (PES) or fitness reports (FITREP). The MMSB dataset is used to augment the TFDW data with critical performance indicators for follow-on descriptive statistics and regression analysis in modeling. Essentially, the final TFDW dataset was used as a reference, listing the officers by name for FITREP data pulling within the MMSB system. The same methodology of TFDW data pulling was used for the MMSB FITREP data. "Snapshots" of FITREP performance data for eligible O-4s were taken

coincident of the TFDW data pulls and the convening date of each corresponding FY promotion board (Table 4). However, only performance data in the rank of major (O-4) was pulled and used for analysis in the study. Performance data of sampled Marines from ranks below major was considered extraneous and irrelevant in follow-on selection probability to lieutenant colonel (O-5). The most recent data in the current rank and responsibility strata of an O-4 is considered the most critical performance factor in determining promotion potential to the next rank.

1. MMSB Dataset Coding, Cleaning, and Structure

The raw MMSB datasets were similar to the initial TFDW datasets in that each unique identifier (O-4) had several rows of data. Each row of MMSB raw data corresponded to individual FITREPs of sampled officers. As such, each row of data provided critical performance indicators of the individual Marine for follow-on statistical analysis, and thus could not simply be dropped to one indiscriminate row of performance data per officer. Similar to the TFDW dataset restructure, then, the MMSB sets were collapsed onto one row of performance data per unique identifier (or eligible O-4) that maintained the informational content of the original multi-row format. All FITREP data was considered integral to the study, and thus required representation in the final dataset, but in a condensed format. Additionally, the raw MMSB datasets had a much smaller quantity of unique identifiers because the collapsed TFDW dataset (above and in-zone officers only) that was further modified by MMPR data, was used to generate the MMSB name list of officers for performance data pull.

The collapse operation tabulated a number of critical individual performance indicators from multiple personal FITREPs into one row of data per officer by LCN. The following list describes the collapse operation and the individual performance indicators tabulated:

- Number and type of reports; combat, normal (or peacetime), academic, and not observed
- Sum of evaluated days calculated from the FITREP “From” and “To” dates

- Average grade by each FITREP attribute (14 total)
- Average overall Reporting Senior FITREP grade expressed on a 4.0 scale
- Average overall Reviewing Officer grade and percentile
- Average physical characteristics; physical fitness score, height/weight and body fat

The final MMSB datasets were merged with their corresponding fiscal year TFDW cohort datasets. The individual rows of observations were matched on a one-to-one basis by their unique LCNs (i.e., the sample officers), which is the common unique identifier between the two sets.

E. FINAL DATASET

After merging, the final dataset included the demographic, experiential, and performance data (x_i) of a comprehensive sample of Marine O-4s eligible for promotion to O-5, from the FY2004-2012 promotion selection boards. The sample size is 8,271 observations representing 4,404 unique officers. The reason there are more observations than number of unique officers is due to the fact that those who were not selected for promotion on a previous board are reconsidered in future boards. In other words, every officer that is passed for promotion and considered again on the next promotion board, reenters the dataset with the same unique identification (i.e., same LCN). However, these repeating officers are indeed considered unique observations, as they are competitive for the same promotion vacancies as all other eligible officers of a particular board, under the above-zone category. The number of unique identifications equals the number of observations for each particular promotion board. For the purposes of statistical analysis in isolating promotion selection effects, a particular observation's identification is considered unique as long as it occurs only once for a particular fiscal year promotion board.

Finally, after aggregating the two datasets, the LCNs were dropped in favor of unique and anonymous study identifications. The final dataset possess no personally

identifiable information (PII) in name, social security number, or lineal control number. The NPS Institutional Review Board approved the study.[13]

F. SUMMARY

The study's dataset is a representative sample of the Marine O-4s eligible for promotion to O-5 from FY 2004 through 2012. The sample is composed of 8,271 unique observations, sourced from TFDW and MMSB. The promotion effects of the aviator MOS will be analyzed through the dataset's 180 custom-coded variables that include key information in demographics, experience, and performance, necessary to isolate the study's key variable of interest.

[13] NPS IRB#: NPS.2011.0006-AM01-EP7-A.

V. VARIABLES DESCRIPTION

A. INTRODUCTION

The purpose of this chapter is to provide detailed information on the variables used in the analysis. The variables were chosen and specifically coded for the express purpose of answering the primary and secondary research questions regarding aviation effects in promotion selection probability to O-5, in the Marine Corps.

B. DEPENDENT VARIABLE

The dependent variable of the study is promotion selection to O-5. The dependent variable takes on the value of 1 if a study officer is selected for promotion to O-5 and 0 otherwise. The data source for this variable is the Total Force Data Warehouse (TFDW).

C. EXPLANATORY VARIABLES

The study's explanatory variables are organized into six categories that describe factors that predict promotion selection to O-5. USMC promotion policy is the foundation for promotion selection factors. That policy describes a promotion system that selects the best and most qualified from among the unrestricted officer population, independent of any institutional favoritism towards race, gender, marital/dependent status, occupational field, or commissioning source. Furthermore, the promotion selection board is mandated to exclusively use the Official Military Personnel File (OMPF) of eligible O-4s for review of service performance in determining potential for increased rank. Within the OMPF, the key document for review of military performance is the Master Brief Sheet (MBS), which succinctly describes the eligible Marine to the promotion board with regard to the following characteristics:

- Military Occupational Specialties
- Training Summary
- Languages

- Education Summary
- Awards
- Performance Evaluation Summary

The categories of variables used in the analysis, therefore, closely mirror the general performance categories of the MBS with the addition of demographics attributes and particular promotion board effects. Though Marine Corps promotion boards likely do not consider demographics in selection consideration, there is a plethora of academic evidence pointing to systematic effects on promotion probability explained by demographics (see Chapter. III). It is therefore necessary to control for demographics in isolating any purposed "aviation effect" on promotion. The study's explanatory variables are organized into six categories, which are the focus of the remainder of the chapter:

1. Demographics
2. Military Occupational Specialty (MOS)
3. Training & Education
4. Performance
5. Experience
6. Promotion Boards & Zones

1. Demographics

The demographics category includes characteristics of eligible Marines not specifically associated with military performance, training, or experience. Most of the demographic variables come from the TFDW source. A unique aspect of the study is the use of the height/weight continuous variable that accounts for the Marine Corps' professional emphasis on military appearance. Table 9 summarizes variables in the model in this category. The "Expected Sign" column hypothesizes the expected variable effect on probability of promotion in later multivariate regression analysis. An expected sign of "UNK" indicates "unknown" and that the researcher makes no particular hypothesis regarding effect.

Table 9. Demographics Category

Variable Label & Description	Range	Expected Sign
Female	=1 if female; 0 if male	UNK
Married	=1 if married; 0 if otherwise	+
Dependents	0 – 9	+
White	=1 if white; 0 if otherwise	UNK
Black	=1 if black; 0 if otherwise	UNK
Hispanic	=1 if hispanic; 0 if otherwise	UNK
Other Race	=1 if other race; 0 if otherwise	UNK

2. Military Occupational Specialty

The military occupational specialty (MOS) category includes the study's key variable of interest, the aviation occupation. The MOS category has various dimensions of the aviation occupation such as general occupational field, aircrew designation, aircraft-type communities (fixed-wing and rotary wing), additional/secondary aviation MOSs, and specific type/model/series aircraft PMOSs as shown in Table 10. The study will leverage these different dimensions of the basic aviator MOS in formulating a model with the descriptive variable (or set of variables) that best predicts promotion outcomes. Additionally, categorical variables of other key MOSs are created in order to answer the sponsor's research question of comparative effects between the aviation, infantry, and logistics fields. The data source of this category of variables is TFDW.

Table 10. MOS Category

Variable Label & Description	Range	Expected Sign
Aviation: Indicates presence of a 75XX MOS	=1 if MOS is 75XX; 0 otherwise	-
Infantry: Indicates presence of an 03XX MOS	=1 if MOS is 03XX; 0 otherwise	+
Logistics: Indicates presence of an 04XX MOS	=1 if 04XX; 0 if otherwise	+
Specific to Aviation Only		
Aviator: Indicator of a naval aviator designation	=1 if aviator; 0 if otherwise	+
NFO: Indicator of an NFO designation	=1 if NFO; 0 if otherwise	-
FW Community: Indicates fixed-wing aircraft-type community	=1 if FW; 0 if otherwise	+
RW Community: Indicates rotary-wing aircraft-type community	=1 if RW; 0 if otherwise	-
75XX: Aircraft Type/Model/Series PMOS	=1 if 75XX; 0 if otherwise	UNK

a. Additional/Secondary MOS

The additional and secondary MOS variables isolate the effects of aviators and NFOs that acquire additional skills associated with the aviation occupational field. In particular, the Weapons & Tactics Instructor (WTI) and Aviation Safety Officer (ASO) skills demonstrate increased responsibility within operational squadrons. Additionally, the Forward Air Controller (FAC) skill indicates an important nuance of the aviator

MOS, one in which integrates the requisite knowledge of combat aeronautics with ground combat. Aviators that possess the WTI, ASO, and FAC MOSs require variables that isolate them from aviators who do not possess these additional skills.

Table 11. MOS Category, Additional/Secondary MOS

Variable Label & Description	**Range**	**Expected Sign**
WTI: Indicates presence of the 7577 MOS	=1 if 7577; 0 if otherwise	+
ASO: Indicates presence of an 7596 MOS	=1 if 7596; 0 if otherwise	+
FAC: Indicates presence of an 7502 MOS	=1 if 7502; 0 if otherwise	+

b. Critical MOSs

The MOS category also isolates the effects of "skill guidance" in critically short MOSs listed in the promotion board precept messages (see Chapter. II). Appendix B lists the critical MOSs of promotion fiscal years 2004–2012. The study's critical MOS variable indicates an observation that has a critical MOS associated with the appropriate fiscal year promotion board, as shown in Table 12.

Table 12. MOS Category, Critical MOS

Variable Label & Description	Range	Expected Sign
Critical MOS: Indicates a designated "critical" MOS in precept	=1 if critical MOS; 0 if otherwise	+

3. Training and Education

The next category of explanatory variables isolates the effects of training and education (T&E) on promotion. Again, TFDW provides the data for this set of variables. The education component of the T&E category is comprehensive, beginning with a Marine officer's civilian education background and commissioning source, through fully funded graduate education (FFGE) and upper-level Professional Military Education (PME). The T&E category also includes specific Marine qualification training in martial arts, marksmanship, and physical fitness.

a. Civilian Education Level

The civilian education category indicates the highest level of non-military education achieved at the convening of the promotion selection board (Table 13). The study's education level category closely resembles the description of "civilian education" in promotion board results messages.

Table 13. T&E Category, Civilian Education

Variable Label & Description	Range	Expected Sign
Bachelor's Degree: Indicates bachelors degree (BD)	=1 BD; 0 if otherwise	UNK
Master's Degree: Indicates masters degree (MD)	=1 if MD; 0 if otherwise	+
PM / PhD: Indicates Post Masters degree (PM), or doctorate (PhD)	=1 if (PhD); 0 if otherwise	+

b. Commissioning Source

The commissioning source sub-category is composed of all entry sources present within the study's sample, and that are listed under the "source of entry" category typical of promotion board results messages.

Table 14. T&E Category, Commissioning Source

Variable Label & Description	Range	Expected Sign
OCC: Indicates entry source Officer Candidate Course	=1 if OCC; 0 otherwise	UNK
PLC: Indicates entry source Platoon Leaders Course	=1 if PLC; 0 if otherwise	UNK
Enlisted Program: Indicates entry source from enlisted to officer program (i.e., ECP/MCP/MECEP)	=1 if enlisted program; 0 if otherwise	UNK
NROTC: Indicates entry source Navy Reserve Officer Training Course	=1 if NROTC; 0 if otherwise	UNK
Naval Academy: Indicates entry source Naval Academy	=1 if Naval Academy; 0 if otherwise	UNK

c. Professional Military Education (PME)

The completion of appropriate level PME, "demonstrates an officer's commitment to self-improvement and represents a desire to prepare for positions of increased responsibility" (Precept Convening the FY12 USMC Lieutenant Colonel Promotion Board, para. 9.a.). This description of PME within promotion selection board precept messages necessitates the need to isolate the effect of Intermediate Level School (ILS) on promotion selection, which indicates successful completion of appropriate level PME for O-4s. Marine O-4s have a buffet of choices and opportunities in which to complete ILS. Marine O-4s can apply for resident programs that entail nine to ten

months of uninterrupted academic focus at one of the four U.S. Military Command & Staff Colleges, or complete non-resident distance courses from the same institutions. Marine O-4s can also apply for exchange programs to foreign military institutions accredited for ILS. Participating foreign nations with accredited schools include Australia, France, Norway, Spain, and South Korea.

Table 15. T&E Category, PME

Variable Label & Description	Range	Expected Sign
PME Complete: Indicates PME complete for grade	=1 if PME complete; 0 if otherwise	+
Resident USMC: Indicates resident PME complete at USMC C&S	=1 if resident USMC C&S; 0 if otherwise	+
Nonresident: Indicates PME complete through nonresident program	=1 if non-resident; 0 if otherwise	+
Resident Other: Indicates resident PME complete at other U.S. or foreign institution	=1 if resident non-USMC PME; 0 if otherwise	+

d. Fully-Funded Graduate Education (FFGE)

The FFGE variable includes two USMC-sponsored programs that provide Marine officers graduate education at no personal cost: the Special Education Program (SEP) and Advanced Degree Program (ADP). SEP and ADP are conducted at one of four institutions: the Naval Postgraduate School (NPS), the Air Force Institute of Technology (AFIT), University of Maryland (UMD), or San Diego State University (SDSU). The Special Education and Advanced Degree Programs incur additional service obligations for participating officers, and the achievement of an additional MOS. The presence of additional MOSs within Marines' records, that are specifically associated

with SEP and ADP, are used to proxy FFGE. The FFGE career path is considered non-standard for aviators and NFOs, though not officially discouraged. Nevertheless, FFGE removes aviation officers from their occupational field for up to five years or more, which may have significant effects on promotion selection probability.

Table 16. T&E Category, FFGE

Variable Label & Description	Range	Expected Sign
FFGE Any Institution: Indicates SEP/ADP participation at any institution	=1 if FFGE participation; 0 if otherwise	-
NPS: Indicates NPS graduate	=1 if NPS; 0 if otherwise	-
AFIT: Indicates AFIT graduate	=1 if AFIT; 0 if otherwise	-
Civilian University: Indicates UMD or SDSU graduate	=1 if UMD/SDSU; 0 if otherwise	-

e. Marine Corps Martial Arts Program (MCMAP)

The martial arts category indicates the highest level of proficiency achieved as measured by the official MCMAP belt classification system. There are six degrees of black of belt and three levels of instructor under MCMAP; however, the study aggregates all black belt degrees, instructor levels, brown, green, and gray belts under the "Gray & Above" category due to small sample size at the higher level of proficiency.

Table 17. T&E Category, MCMAP

Variable Label & Description	Range	Expected Sign
Tan Belt: Indicates tan belt qualification	=1 if tan; 0 if otherwise	+
Grey Belt & Above: Indicates grey belt through instructor qualification (includes green, brown, & black)	=1 if grey & above; 0 if otherwise	+

f. Marksmanship Qualification Training

The Marine ethos of "every Marine a rifleman" is demonstrated by the requirement for annual marksmanship training in the M-16A2 Colt service rifle and the M-9 Berretta pistol. Upon reaching the rank of major (O-4), Marine officers are no longer required to re-qualify in the rifle. However, the last rifle score and qualification achieved is listed on the Marines' MBS, and thus presumably considered by the promotion board in selection criteria. Annual pistol re-qualification is required of O-4s, and the score and qualification level is listed in the MBS.

Table 18. T&E Category, Marksmanship Qualification Training

Variable Label & Description	Range	Expected Sign
Rifle Expert: Indicates rifle expert	=1 if expert =0 if otherwise	+
Pistol Expert: Indicates pistol expert	=1 if expert =0 if otherwise	+

g. Military Appearance and Physical Fitness Test (PFT)

A unique aspect of the study is the use of the height and weight variables to account for the Marine Corps' professional emphasis on military appearance. Most of the data elements for this category are obtained from MMSB. Physical fitness and military appearance are hallmarks of the Marine Corps. Eligible-for-promotion Marines are directed to include an official and current photograph of themselves within their OMPF for review by the promotion board. Since there is no way to measure photographic appearance for statistical analysis, the study uniquely isolates the military appearance variable through alternative means.

Military appearance is objectively enforced in the Marine Corps through the Marine Corps Body Composition & Military Appearance Program (MCBCMAP). Height, weight, body fat, and physical fitness standards are promulgated through the MCO6100.12 and regulated through semiannual weigh-ins and Physical Fitness Tests (PFT). Marines that fail to meet the basic height/weight standard are tested further for body fat and fitness, the next echelon of military appearance standards. If Marines meet the body fat and fitness criterion, they are considered within military appearance standards. However, those Marines that fail to meet the body fat or fitness standard are placed in the Body Composition Program (BCP). BCP is a fitness and appearance remedial program. BCP is also used to initiate the formal administrative discharge process of "outside-of-standard" Marines if the program's objectives are not met. Military appearance is controlled in the study through a set of variables that objectively measure Marines' appearance by placing them in one of three categories: within height/weight standards, within body fat standard, or body composition program (i.e., outside of both height/weight and body fat/fitness).

Table 19. T&E Category, Military Appearance

Variable Label & Description	Range	Expected Sign
Height: Height in inches	59 – 80 inches	+
Weight: Weight in pounds	93.5 – 278.7 pounds	-
Ht/Wt Standard: Indicates within defined ht/wt standards	=1 if within ht/wt standards; 0 if otherwise	+
Body Fat Standard: Indicates outside of ht/wt standards but within body fat standards	=1 if within BF standards; 0 if otherwise	-
BCP: Indicates Body Composition Program; i.e., outside of both ht/wt & body fat standards	=1 if in BCP; 0 if otherwise	-

Much like the military appearance standards, the annual PFT requirement demonstrates the Marine Corps' great emphasis on physical fitness. The Combat Fitness Test (CFT) has recently replaced the once semi-annual requirement of the PFT (circa CY 2009). The PFT is now only required during the first half of the calendar year, and the CFT is taken during the second half. There is not enough data compiled on the CFT to use in the current study.

Table 20. T&E Category, PFT

Variable Label & Description	Range	Expected Sign
PFT Avg: Avg PFT score in points as an O-4	123-300 points	+
PFT 1st Class: Indicates 1st class PFT; determined by avg score as O-4	=1 if 1st class PFT; 0 if otherwise	+

4. Performance

The performance category is considered the most critical and complex set of variables evaluated in the study with regard to accurately isolating the effects of the aviation MOS on promotion probability. Without adhering to the econometric imperative of controlling for personal performance, any statistical results favoring an "aviation effect" would be spurious at best, suffering from omitted variable bias. However, as long as the model controls for prior performance on promotion rate, the coefficients on the MOS variables essentially compare the rate of promotions across the MOS, assuming the officers have the same level of performance. Complexity in this category is magnified by the fact that performance evaluators have unique trends and apply personal subjectivity in how they evaluate individuals. Raw performance scores, therefore, cannot be taken at face value. In order to provide more standardized measures of performance, the researcher constructed several "normalizing" variables that account for relative differences in performance evaluation idiosyncrasy of evaluators.

The performance category encompasses the evaluative aspects of a Marine O-4's service. Data associated with individual Marines' service is numerous and unwieldy, if approached from the standpoint of an entire career. Additionally, the most recent performance in the current rank/grade (O-4/major) is assumed to be the most important in determining selection for promotion. Therefore, only performance data in the grade of O-4 is used to isolate its effects on the probability of promotion.

Finally, RS and RO cumulative relative values are used in lieu of "at processing" values. MMSB accounts for the effect of RS and RO grading trends, with regard to individual reports, by two related measures; "at processing" and "cumulative" values. The "at processing" value compares a FITREP's grade with all reports received prior to the FITREP's receipt date, of the particular RS/RO of MROs of the same rank/grade. The "at processing" value is stable over time and does not change since it compares only previous values at the time the FITREP is received by MMSB. The "cumulative" measure, however, changes over time as it compares a FITREP's grade to all other FITREP grades, both prior and after the report's receipt date at MMSB. The cumulative

value of a particular FITREP adjusts to RS/RO's grading trends as they develop over their careers and as they evaluate more MROs of a particular rank/grade.

The cumulative values are chosen for the study, vice "at processing," because they account for evaluator's relative grading trends current as of this study. The counterargument to using cumulative data is that it accounts for evaluator's trends *beyond* the particular promotion board proceedings, and therefore does not accurately reflect the performance information that the board considered. However, without the ability to recover "snapshot" cumulative value (i.e., cumulative value at the time of the particular promotion board), overall cumulative is superior to "at processing" values. The goal of using the performance variables is not necessarily to reconstruct the promotion board's deliberation process, but rather to best control for an individual's prior performance on the probability of promotion. From this perspective, using the most data available better isolates the effect of individual performance. The relative performance value of a particular individual is better expressed in light of more evaluator reports vice less.

a. Performance Evaluation System (FITREPs)

According to Marine Corps policy, the most critical performance tool in determining a Marine's potential for promotion is the FITREP (see Chapter II), The data contained under the study's FITREP performance category is largely drawn from MMSB, and includes only reports from the O-4 grade. Notwithstanding this intentionally narrow focus of performance reports in only one rank, numerous reports are available, averaging 8.7 FITREP's per officer. Therefore, the FITREP data is collapsed and organized under the following sub-categories that succinctly measure an individual's relative performance:

- ***Reporting Senior Attribute Relative Value (ARV)***
- ***Reporting Senior Relative Cumulative Value (RV)***
- ***Reviewing Officer Relative Cumulative Value (ROCV)***

Individual performance is captured by three different, but related, measures in order to analyze specific FITREP attributes, the overall FITREP grade, and

the additional level of evaluation provided by the RO. The underlying assumption is that more performance data gathered and analyzed, the greater the statistical precision in the regression estimates. The RS's direct evaluation of the MRO by individual FITREP attribute (i.e., mission accomplishment, courage, leadership, etc) is captured in the ARV. The RV is representative of the RS's overall evaluation of the MRO (i.e., aggregated FITREP attribute grades). Finally, the ROCV captures the additional level of evaluation provided by the RO.

The **Reporting Senior Attribute Relative Value (ARV)** is an original metric developed in this thesis. The purpose of the ARV is to compare Marines based on individual FITREP attribute averages. Under the current PES and MBS format, there is no metric for comparing Marines' along FITREP attribute lines, such as "leadership," "initiative," "courage," etc (See Chapter. II). Instead, the only provision for comparing Marines' performance is the overall FITREP relative value. When analyzing the possibility of systematic differences between occupational specialties, implying differing promotion rates, research naturally begs the question of particular areas of strengths and weaknesses in performance associated with MOS. The ARV attempts to answer this question by averaging the relative score for each of the 14 FITREP attributes, for follow-on comparison between occupational fields.

The ARV is computed with a simple formula that applies the RS's overall FITREP grading average to an individual MRO (Marine Reported On) attribute grade. Table 21 summarizes the 12 attributes that were used in computing the ARV. The formula then converts the MRO attribute raw grade into a relative grade for comparison with other MRO's of RS's who have unique grading averages (Figure 17). The 4.00 value of the formula is used as the median value of the FITREP attribute score, which ranges from one to seven.

(MRO Attribute Grade – RS Average) + 4.00 = ARV

Figure 17. Computing ARV

Table 21. Performance Category, ARV

Variable Label & Description	Range
Mission Performance: Average relative value in "mission performance" attribute	2.58 – 5.81 points
Mission Proficiency: Average relative value in "mission proficiency" attribute	1.69 – 5.88 points
Courage: Average relative value in "courage" attribute	1.82 – 5.32 points
Effectiveness under Stress: Average relative value in "effectiveness under stress" attribute	1.91 – 5.56 points
Initiative: Average relative value in "initiative" attribute	2.74 – 6.16 points
Leading Subordinates: Average relative value in "leading subordinates" attribute	2.58 – 5.92 points
Developing Subordinates: Average relative value in "developing subordinates" attribute	2.08 – 5.47 points
Setting the Example: Average relative value in "setting the example" attribute	2.44 – 5.35 points
Ensuring Well-Being of Subordinates: Average relative value in "ensuring well-being of subordinates" attribute	2.14 – 5.03 points
Communication Skills: Average relative value in "communication skills" attribute	1.69 – 5.58 points
Decision Making: Average relative value in "decision making" attribute	2.58 – 5.23 points
Judgment: Average relative value in "judgment" attribute	1.69 – 5.52 points

The **Reporting Senior Relative Cumulative Value (RV)** measures the average "normalized" overall score of an individual officer's FITREPs, as an O-4. The RV is not an original metric developed by the study, but rather tabulates and averages the existent cumulative relative values for each FITREP as provided by MMSB.

Another original metric designed to answer the research questions of the study, is the **Reviewing Officer Relative Cumulative Value (ROCV)**. The ROCV normalizes reviewing officer's comparative assessment markings for an accurate comparison between MROs, or groups of MROs, which have different ROs. Like reporting seniors, reviewing officers each have their own unique grading tendencies, preventing "direct read" comparison of MROs purely on raw comparative assessment marks. The Master Brief Sheet (MBS) does not address this shortfall in comparative performance marks; however, it does provide all of the data necessary to compute the new metric (Figure 18).

1. ***Find RO's Multiplied Average Assessment Value:***

   Tot Value of Assessments / Tot Assessments = RO Multiplied Avg

2. ***Calculate ROCV:***

   MRO Assessment Score - RO Multiplied Avg = ROCV

Figure 18. Computing ROCV

The resulting ROCV numeric yields a "distance from," or "tree levels" above/below, the RO's average value on the comparative assessment tree. For example, a ROCV value of +1.00 means that the MRO's relative assessment is one entire "tree level" higher than the RO's average on the comparative assessment (see Figure 19 for a detailed example). The ROCV does not produce an absolute "tree level" from which to compare MROs, or groups of MROs. Instead, the ROCV simply quantifies the numbers of levels (+/-) the particular MRO (or group) tends to vary from an RO's cumulative average.

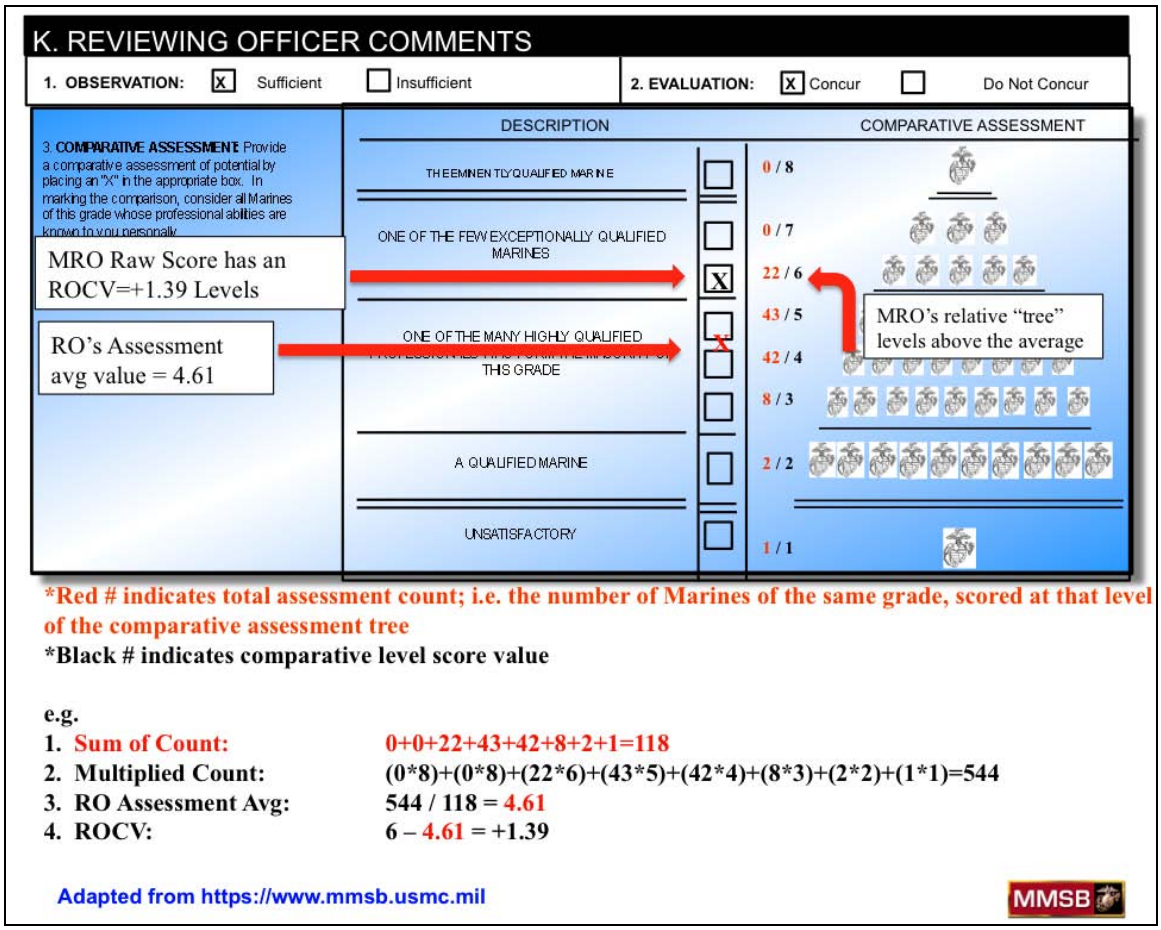

Figure 19. ROCV Example (after MMSB)

Table 22. Performance Category, RV & ROCV

Variable Label & Description	Range	Expected Sign
Relative Value: Average overall FITREP relative value	80.0 – 100.0 points	+
ROCV: Average RO cumulative relative value	-4.43 – 2.42 levels	+

b. Awards

The awards variable is another important component in capturing individual performance through the achievement of decorations associated with commendatory or extraordinary performance. Awards are expressed in terms of number of awards per officer. Only personal awards are considered as the goal is to simply better isolate individual performance within the aviation-restricted sample. Table 23 lists the personal awards variables in official precedence order.

Table 23. Performance Category, Personal Awards

Variable Label & Description	Range	Expected Sign
Meritorious Service: Indicates receipt of the Meritorious Service Medal(s)	0 – 4 awards	+
Air Medal (IA): Indicates receipt of the Air Medal(s) – Individual Action	0 – 6 awards	+
Air Medal (S/F): Indicates receipt of the Air Medal(s) – Strike / Flight	0 – 26 awards	+
Navy Commendation: Indicates receipt of the Navy & Marine Corps Commendation Medal(s)	0 – 6 awards	+
Navy Achievement: Indicates receipt of the Navy & Marine Corps Achievement Medal(s)	0 – 5 awards	+

5. Experience

The experience category isolates the effect of various aspects of military service experience. Specifically, the Marine Corps' "warfighter" ethos, and the DoD-wide respect for leadership experience, is presumed to play an integral part in selection for promotion to greater responsibility. There is not, however, a specific listing of operational experience or combat deployments of eligible officers presented to promotion boards. This kind of information is instead drawn from a detailed analysis of the

"Performance Evaluation Summary" of the MBS, which is a simplified summary of an individual's FITREP history. Therefore, the researcher has reconstructed experience variables from the MMSB performance data, much like a promotion selection board member. As in the performance category, only military experience in the rank/grade of major/O-4 is considered in the study.

a. Combat Deployment

Former Marine Corps Commandant General James T. Conway directed "every Marine to the fight," specifying his intent for every Marine to experience combat associated with the Global War on Terrorism (ALMAR 002/07, January 19, 2007). Additionally, since the GWOT began, the Overseas Control Date (OCD) policy was redressed. The redress included clearer definitions of Hostile Fire Area (HFA) locations and the requirement for 180 days of continual service within an HFA to qualify for resetting an individual's OCD (MARADMIN 577/44, December 29, 2004).

The combat deployment variables in this thesis are constructed in a similar manner to the recent Commandant's directive and Marine Corps OCD policy. Combat deployments are uniquely captured in the study by use of a proxy variable because the direct TFDW deployment data proved to be too unreliable to measure deployments. Instead of directly measuring deployments form the typical source (TFDW), the study uses a proxy for combat deployments by tabulating FITREP combat duty evaluations. MMSB FITREP evaluations annotated with a "C" (combat duty) for duty type, and having an evaluated time of at least 180 days, are used to proxy 180-day or more combat deployments. Also, since the study focuses on Marine Corps promotions post 9/11, during the era of the GWOT, separate combat deployment variables indicate service experience in Afghanistan and Iraq. The study's combat deployment variables are shown in Table 24 and specifically defined as:

- Combat FITREP evaluations covering 180 continuous days or more (MMSB), in the rank of major (O-4)
- Deployments to Afghanistan or Iraq (TFDW)

Table 24. Experience Category, Combat Deployments

Variable Label & Description	Range	Expected Sign
Combat Report (binary): Indicates at least one combat evaluation covering 180 days or more as an O-4	=1 if combat report as an O-4; 0 if otherwise	+
1 Combat Report: Indicates one combat evaluation of 180 days or more as an O-4	=1 if one combat report as an O-4; 0 if otherwise	+
2 Combat Reports: Indicates two combat evaluations of 180 days or more as an O-4	=1 if two combat reports as an O-4; 0 if otherwise	+
3+ Combat Reports: Indicates three or more combat evaluations of 180 days or more as an O-4	=1 if three or more combat reports as an O-4; 0 if otherwise	+
Combat Months: Counts the number combat months	0 – 31.4 months	+
Deployed to Afghanistan: Indicates at least one deployment to Afghanistan as an O-4	0 – 1	+
Deployed to Iraq: Indicates at least one deployment to Iraq as an O-4	0 – 1	+

c. Squadron Experience

The squadron experience variables only apply to the aviation sample. The squadron experience variables indicate colloquial notions of important factors for aviators in promotion selection attractiveness, such as:

- Evaluated Time in PMOS (i.e., the flying squadron, or "time in the cockpit")
- Department Head Tour in PMOS

"Time in the cockpit" is the colloquial term given to squadron assignments of aviators performing the actual skills of their PMOS. Tactically and technically proficient aviators are maintained through familiarity in the actual day-to-day operations of a flying squadron.

Table 25. Experience Category, Squadron Experience

Variable Label & Description	Range	Expected Sign
Squadron Tour: Indicates at least one tour in a flying squadron	=1 if squadron tour; 0 if otherwise	+
Squadron DeptHd: Indicates department head tour in a flying squadron	=1 if squadron dept hd; 0 if otherwise	+
Squadron Months: Counts the number of evaluated FITREP months as in squadron assignment	0 – 66.1 months	+
Squadron Time to TIG: Ratio of evaluated time in squadron assignment to time-in-grade	0 – 1.03	+
Operations Officers (OspO): Indicates OpsO billet experience in a flying squadron	=1 if squadron OpsO; 0 if otherwise	+
Maintenance Officer (MO): Indicates MO billet experience in a flying squadron	=1 if squadron MO; 0 if otherwise	+

The above notions imply that promotion boards place great emphasis on "MOS credibility"; that is, having experience in one's PMOS. However, another colloquial notion asserts that "time in the cockpit" needs to be balanced with non-flying experience in other Marine Corps functions such as staff, resident PME, or even joint service. Leadership billets in the squadron of an aviator's PMOS are also considered an integral component in demonstrating potential for greater responsibility of higher rank. Quantifiable leadership in the flying squadron for O-4s is defined as the Operations Officer (OpsO) and Maintenance Officer (MO) billets. These leadership positions (OpsO and MO) are considered squadron "department head" billets, and presumably excellent resume items for promotion selection. The squadron experience variables are shown in Table 25.

6. Promotion Boards and Zones

Each fiscal year promotion board is composed of different and distinct members of varying military experience, and MOS background. These board members decide on which of the eligible O-4s are selected for promotion for a given year. As such, fiscal year indicators are included to isolate the promotion selection effects of particular promotion boards, as shown in Table 26. Additionally, the occurrence of repeat eligible officers (i.e., previously considered for promotion and passed over) is accounted for in the "above-zone" variable within this category.

Table 26. Promotion Board Category

EV Name	Range	Expected Sign
fyXX: Indicates fy20XX promotion board	=1 if fyXX; 0 if otherwise	UNK

D. SUMMARY

The study's variables are designed to explore the statistical existence of a purported "aviation effect" on promotion to lieutenant colonel (O-5) in the Marine Corps. The analytical scheme of maneuver includes the use of a binary dependent variable for promotion selection to O-5, and six categories of explanatory variables that thoroughly capture the factors for field grade officer promotion. The environment of Marine officer promotions is complex and nuanced with caveats, wickets, colloquialisms, and "urban legends." However, through statistical analysis, data-driven evidence secures a reliable answer to the officer promotion research question. The inclusion of detailed Marine officer information during their O-4 career in the model allows the researcher to compare the promotion rates across the key MOS categories among officers of comparable characteristics.

VI. PRELIMINARY DATA ANALYSIS

A. INTRODUCTION

Preliminary analysis consists of descriptive statistics of the study's promotion board sample from fiscal years 2004 through 2012. Analysis is conducted on three separate samples: full sample (n=8,271), in-zone restricted (n=4,208), and in-zone aviation restricted (n=1,619). The full sample is analyzed with exclusive attention on differing promotion selection opportunity between occupational fields (or MOSs). The in-zone sample focuses analysis on the same occupational field comparison in promotion selection opportunity, but with greater attention to other promotion factors. The specific factors for promotion of aviators are analyzed in the aviation-only sample.

The dependent variable of promotion selection to O-5 is analyzed first and from multiple perspectives. The study's explanatory variables are then analyzed from two perspectives: overall summary statistics and statistical relationships between promotion selection and various promotion predictors. The study's explanatory variable categories are as follows and analyzed in the following order:

- Demographics
- Military Occupational Specialty
- Performance
- Training & Education
- Experience
- Promotion Boards & Zones[14]

The overall theme of the analysis is the relationship between the study's hypothesized promotion predictors and actual promotion selection. This relationship

[14] The "Promotion Boards and Zones" category is not analyzed in detail. Each fiscal year's promotion board represents approximately 10% of the full sample. The above zone candidates represent 49.1% of the full sample.

between promotion factors and selection is particularly analyzed within the in-zone and aviation samples, with elements from each explanatory variable category. The relational analysis between promotion factor and selection, however, is not conducted with every explanatory variable (e.g., gender, race, and civilian education). These factors are considered "ordinary" because they have been analyzed in detail in past promotion research. These variables are still included in the study, but only represented in the summary statistics of this chapter and as "controls" in the regression analysis in later chapters.

B. DEPENDENT VARIABLE

The descriptive statistics of promotion selection, the dependent variable, are analyzed within the full, in-zone, and aviation samples.

1. Overall Promotion Selection (FY2004–2012)

The in-zone selection rate of 67.3% was slightly less than the "desired active duty list promotion opportunity" rate of 70% (DODI 1320.13, July 22, 2009, p. 6) in the full sample, as shown in Table 27. The overall selection rate is expressed as an additive percentage, above-zone plus in-zone selection rate, and is known as "selection opportunity." Additionally, the selection opportunity drastically decreased for the above-zone candidates, 67.3% to 5.4%. Because of the marked drop-off in selection rates between the above-zone and in-zone categories, the remainder of the statistical analysis of the dependent variable focuses only on "first-look" eligibility for promotion to O-5 (i.e., in-zone only).

Table 27. Selection Rates, by Promotion Zone & Study Sample (from DODI 1320.13, July 22, 2009, p. 6)

Promotion Zone	Full Sample	In-Zone	Aviation
Above & In-Zone	0.369	0.673	0.321
	(0.483)	(0.469)	(0.467)
Above-Zone	0.054	.	0.045
	(0.226)	(.)	(0.208)
In-Zone	0.673	0.673	0.618
	(0.469)	(0.469)	(0.486)
Observations	**8271**	**4208**	**3360**
Standard deviations in parentheses			

Note: Aviation sample here includes both above and in-zone eligible O-4s.

2. Aviation Promotion Selection

The sponsor initiated the study because of an alarming rate of decreasing O-5 promotion rates for aviators over time. The following analysis compares the promotion rates of the aviator MOS (75XX) to other "large population" MOS groups, and computes the 9-year trend, and degree of volatility between MOSs (Deputy Commandant, Aviation, 2009).

a. Infantry and Logistics Comparison

The following analysis focuses on the sponsor's primary question regarding the decreasing promotion selection rates of the aviation occupational field, compared with other MOSs. The following tables and graphs illustrate the statistical results of the last nine Marine Corps lieutenant colonel (O-5) promotion boards for the in-zone sample, with particular emphasis on the aviation field. The MOS comparison in selection is derived from the sponsor's question, and is categorized as follows:

- All MOSs (i.e., "Fleet")
- Aviation (75XX)
- Infantry (03XX)
- Logistics (04XX)

- Other MOSs (i.e., not aviation/infantry/logistics)

The FY2004-2012 sample, in Table 28, reveals that the aviator MOS suffered a disadvantage of at least 6.3 percentage points (ppt) in promotion selection opportunity from the next closest MOS group (Aviator 61.8% vs. Logistics 68.1%), and a 5.5 ppt disadvantage compared to the overall in-zone sample, or "fleet average" (61.8% vs. 67.3%, Table 27).

Table 28. In-Zone Selection Rates, by MOS

MOS Group	In-Zone
All MOSs	0.673
	(0.469)
Aviation	0.618
	(0.486)
Infantry	0.753
	(0.432)
Logistics	0.681
	(0.467)
Other MOSs	0.694
	(0.461)
Observations	**4208**
Standard deviations in parentheses	

b. Selection Rate Trends

The overall selection rate comparison, however, does not tell the whole story of the differences across MOS groups. The trend comparison presents the statistics from a different perspective, taking advantage of the study's multi-year sample and showing the direction and magnitude of selection rate trends, by MOS group. The sample indicates that though the trend for aviator selection rates is positive, it is below the overall average of all MOSs (Figure 20). The "All MOS" rate increased 0.71 percentage points (ppts) per year over the last nine promotion boards, while the aviator rate increased only 0.32 ppts per year over the same period.

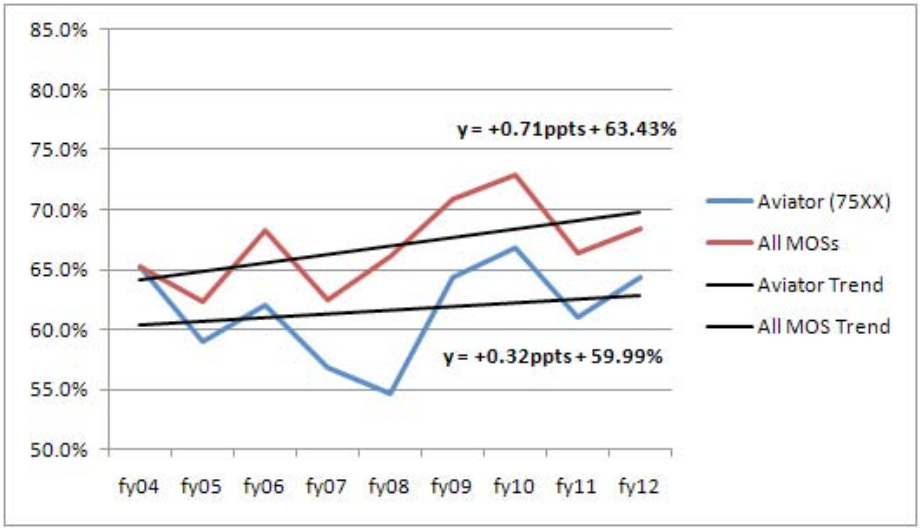

Figure 20. MOS Selection Rate Trend: Aviator & All MOSs

The infantry trend is also higher than aviation. Figure 21 demonstrates that the infantry MOS selection rate increased by an average of 1.02 ppts every fiscal year to present, compared to an annual increase for aviation of 0.32 ppts.

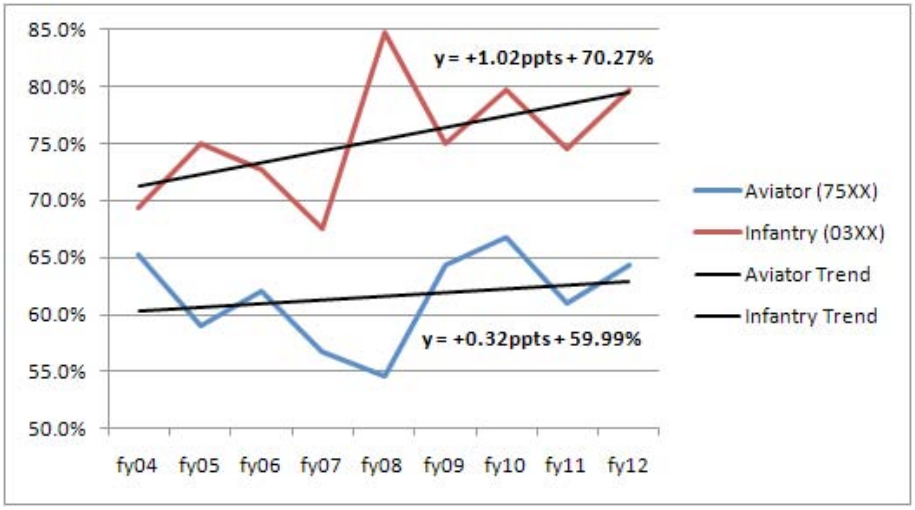

Figure 21. MOS Selection Rate Trend: Aviator & Infantry

The comparison between aviators and logisticians, however, reveals that the logistics MOS is trending negatively since fiscal year 2004 as shown in Figure 22. The logistics MOS suffered from a trend of -0.40 ppts per fiscal year in selection rate, while the aviator trend remains positive.

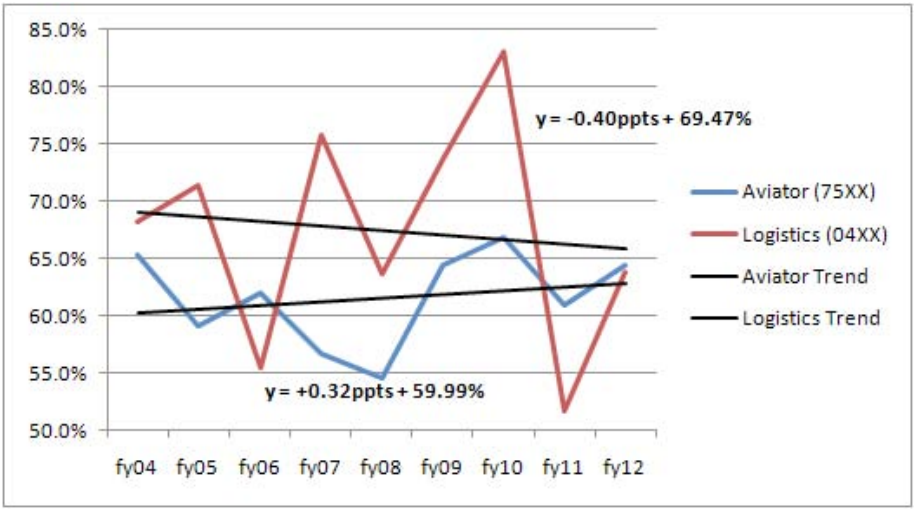

Figure 22. MOS Selection Rate Trend: Aviator & Logistics

The final trend comparison is between aviation and all other MOSs that are neither infantry nor logistics. This last category aggregates all remaining smaller MOSs. All other MOSs fared best among the study's grouping of occupational fields, trending positively 1.18 ppts per fiscal year, which is far higher than the aviation MOS (Figure 23).

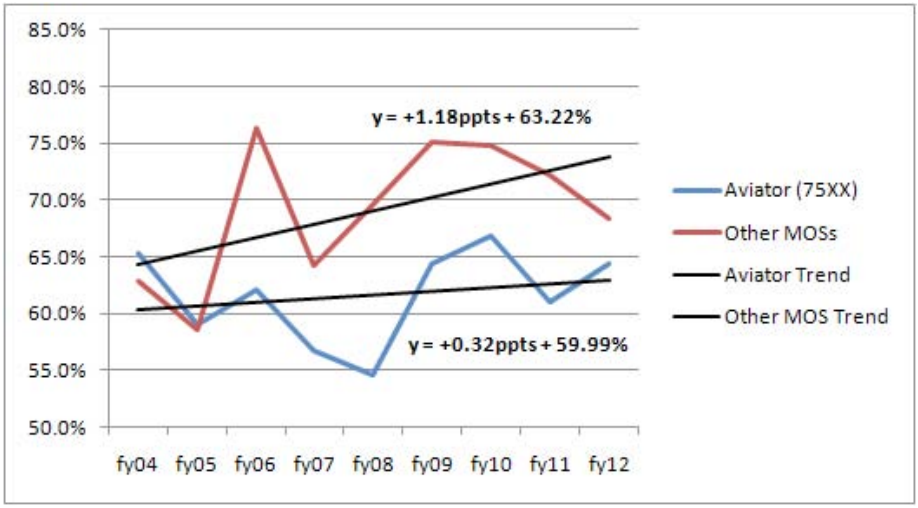

Figure 23. MOS Selection Rate Trend: Aviator & Other MOSs

c. Variability in Promotion Selection Rates

Variability refers to the degree of stability or volatility within occupational fields, in terms of annual selection rates. The line graphs of Figures 20 through 23 illustrate the selection rate variation; the more docile, or linear, the shape of the time-series line, the more stable an MOS's selection rate, and vice versa. However, the magnitude of variation is also depicted with raw numbers, and the use of the coefficient of variation. The coefficient of variation (*cv*) is a unit-less index of variability relative to the average value of the selected data (Keller, pg. 135). The higher the *cv*, the greater the variation and thus the greater the volatility in selection rates from year to year. The *cv* is calculated by dividing the average selection rate by its standard deviation for a given MOS group. Table 29 displays the coefficient of variation of the study's selected MOS groups for comparison. Though the aviator field has the lowest selection rate, it boasts the greatest stability among the other MOS groups as measured by the *cv*. The aviation MOS's 0.067 *cv* represents a 119.4% greater stability compared to logistics, 32.8% greater compared to "other MOSs," and a 6.0% greater stability compared to infantry. The lowest *cv* of the in-zone sample is the combined selection rates of all MOSs. The selection rates of the aviation MOS are 26.4% more volatile than the rates of all Marine Corps field grade officer MOSs combined.

Table 29. Coefficient of Variation of Selection Rate, by MOS Group

Measure	**All MOSs**	**Aviator**	**Infantry**	**Logistics**	**Other MOSs**
Avg. Sel Rate	67.3%	61.8%	75.3%	68.1%	69.4%
Stan. Deviation	3.5%	4.1%	5.4%	9.9%	6.2%
Coeff. of Var.	**0.053**	**0.067**	**0.071**	**0.147**	**0.089**

C. EXPLANATORY VARIABLES

The descriptive statistics of the explanatory variables are analyzed by category and sample. The demographics category is analyzed first in order to provide a background of the officers who make up the samples. The remaining categories are analyzed in the following order: MOS, performance, training and education, and experience ("promotion boards and zones" category is not analyzed). Each category's statistics are described independently. The statistics of the study's hypothesized primary predictors of promotion are described in terms of selected and non-selected to O-5. Other variables not considered as primary predictors (i.e., demographics, civilian education, etc) are described simply with regard to sample mean and number of observations, without selected and non-selected descriptions.

1. Demographics

Table 30 presents the summary statistics of the demographics category. Male is the dominant gender of all three samples (97.7–99.8%), and white represents the largest race demographic (81.4–86.7%). The average age of above-zone O-4s is 39.2 years old, compared with younger in-zone and aviation in-zone O-4s; 38.0 and 37.6 years old, respectively. A large majority of the officers are married and have approximately three dependents.

Table 30. Demographics Summary Statistics, by Sample

Variable	Mean		
	Full Sample	In-Zone Sample	Aviation Sample
Male	0.982	0.977	0.998
	(0.135)	(0.152)	(0.043)
Age	39.208	38.016	37.599
	(2.570)	(2.162)	(1.725)
Married	0.892	0.899	0.910
	(0.310)	(0.301)	(0.287)
Dependents	2.826	2.790	2.819
	(1.434)	(1.409)	(1.339)
White	0.814	0.821	0.867
	(0.389)	(0.384)	(0.340)
Black	0.062	0.054	0.025
	(0.240)	(0.226)	(0.155)
Hispanic	0.045	0.046	0.040
	(0.207)	(0.210)	(0.196)
Other Race	0.080	0.079	0.069
	(0.271)	(0.269)	(0.253)
Observations	**8271**	**4208**	**1619**
Standard deviations in parentheses			

Note: Aviation sample includes only in-zone candidates.

2. Military Occupational Specialty

a. MOS Summary Statistics

The MOS summary statistics are analyzed from two perspectives: the sponsor's "large population" MOS groups, and a breakdown of the aviation occupational field by aircrew designation, aircraft-type communities, and PMOSs.

The aviation occupational field represents the largest MOS group (40.6%), followed by infantry (12.9%) and logistics (7.9%) within the full sample (Table 31). These MOS groups exhibit a similar distribution within the in-zone sample. With regard to "critical MOS," 11% of all MOSs are designated "critically short" within both the full

and in-zone samples. Additionally, 15.4% of all critical MOSs are from the aviation occupational field, 6% from logistics, and 78.5% from all other MOSs. The infantry occupational field was not considered critically short. See Appendix B for detailed description of critical MOS designations.

Table 31. MOS Summary Statistics, by Sample

Variable	Full Sample	In-Zone Sample	Critical MOS
Aviation	0.406	0.385	0.154
	(0.491)	(0.487)	(0.362)
Infantry	0.129	0.146	0.000
	(0.335)	(0.354)	0.000
Logistics	0.079	0.082	0.060
	(0.270)	(0.274)	(0.239)
Other MOS	0.386	0.387	0.785
	(0.487)	(0.487)	(0.411)
Critical MOS	0.112	0.114	1.000
	(0.315)	(0.318)	0.000
Observations	**8271**	**4208**	**480**
Standard deviations in parentheses			

Note: Critical MOS distribution reflective of in-zone sample.

The aviation occupational field's summary statistics are represented in Table 32. Designated naval aviators make up the bulk of the aviation sample (89.9%) with regard to aircrew designation. The rotary-wing community (a.k.a. helicopter) describes the majority of the sample's aircraft-type rated aviators at 58.8%.

Table 32. Aircrew Designation & Aircraft-Type Summary Statistics

Variable	Aviation Sample Mean
Aircrew Designation	
Aviator	0.899
	(0.302)
NFO	0.101
	(0.302)
Aircraft-Type Community	
FW Commnty	0.412
	(0.492)
RW Commnty	0.588
	(0.492)
Observations	**1619**
Standard deviations in parentheses	

Aviator PMOS summary statistics are represented in Table 33. The CH-46E PMOS (7562) is the largest group among T/M/S aircraft at 18.8%. The F/A-18 aviators and NFOs represent the largest fixed-wing community PMOS (7523/7525) at a combined 18.7%. Certain aircraft PMOSs were deemed "critically short" over the FY2004-2012 promotion period; 4.6% of the sampled O-4s had an aircraft PMOS identified as critical during a specific fiscal year promotion board.

Table 33. Aviation PMOS Summary Statistics

Variable	Aviation Sample Mean
AV-8B (7509)	0.098
	(0.298)
F/A-18 (7523)	0.130
	(0.337)
***F/A-18(7525)**	0.057
	(0.232)
MV-22 (7532)	0.041
	(0.199)
EA-6B (7543)	0.019
	(0.137)

KC130(7556/57)	0.063
	(0.243)
CH-46 (7562)	0.188
	(0.391)
UH-1 (7563)	0.067
	(0.250)
CH-53D (7564)	0.030
	(0.170)
AH-1 (7565)	0.130
	(0.336)
CH-53E (7566)	0.132
	(0.339)
***EA-6B(7588)**	0.045
	(0.206)
Critical MOS	0.046
	(0.209)
Observations	**1619**
Standard deviations in parentheses	

b. Promotion Selection and Designation/Aircraft –Type/PMOS

The relationships between MOS and promotion selection are described in the following statistics. Specifically, promotion rates are compared across critical MOSs, aviation PMOSs, and additional aviator MOSs.

The selection rate of MOSs deemed “critically short” varied by promotion zone, as represented in the full and in-zone samples of Table 34. The data revealed a higher selection rate of critical MOSs in all categories compared with the overall selection rates of Table 27. The selection rate of critical MOSs was 39.2% (above & in-zone), and 67.9% for in-zone only. Both selection rates represent a 6.2% and 0.9% respective increase in comparison to the overall selection rates of Table 27. Aviation MOSs designated “critical” enjoyed a 9.4% increase in selection for the in-zone sample (61.8% vs. 67.6%); in-zone selection rates of critical MOSs within the logistics field also were higher by 11.5%.

Table 34. Critical MOS & Selection Rate, by Sample & MOS

Variable	Critical MOS Sel Rate	
	Full Sample	In-Zone Sample
All MOSs	0.392	0.679
	(0.488)	(0.467)
Aviation	0.402	0.676
	(0.492)	(0.471)
Logistics	0.433	0.759
	(0.500)	(0.436)
Other MOS	0.386	0.674
	(0.487)	(0.470)
Observations	**8271**	**4208**
Standard deviations in parentheses		

Note: Infantry was not considered a critical MOS FY04-12.

The in-zone sample selection rates varied by aircrew designation, aircraft-type community, and PMOS, as demonstrated in Table 35. NFOs enjoyed an overall 6.8 percentage point (ppt) advantage over aviators in selection opportunity, though their individual sample sizes are quite different in size (164 and 1,455 respectively). The MV-22 PMOS (7532) had the highest selection rate among the other aircraft PMOSs at 82.1%. The CH-46E community (7562) had the lowest PMOS selection rate of the sample at 53.8%.

Table 35. Selection Rates and Aviation MOSs, Aviation Sample

Variable	Overall Sel Rate	WTI Sel Rate	ASO Sel Rate	FAC Sel Rate
All Aviation	0.618	0.824	0.591	0.642
	(0.486)	(0.381)	(0.493)	(0.480)
Aircrew Designation				
Desig. Aviator	0.612	0.829	0.578	0.634
	(0.487)	(0.377)	(0.495)	(0.483)
Desig. NFO	0.671	0.791	0.813	0.724
	(0.471)	(0.410)	(0.403)	(0.455)
Aircraft-Type Community				
FW Community	0.675	0.852	0.691	0.729
	(0.469)	(0.356)	(0.465)	(0.446)

RW Community	0.579	0.805	0.541	0.585
	(0.494)	(0.397)	(0.500)	(0.494)
Aviation PMOS				
AV-8B (7509)	0.673	0.849	0.643	0.643
	(0.471)	(0.364)	(0.488)	(0.488)
F/A-18 (7523)	0.678	0.867	0.700	0.778
	(0.469)	(0.342)	(0.470)	(0.420)
F/A-18D (7525)*	0.663	0.763	1.000	0.714
	(0.475)	(0.431)	0.000	(0.463)
MV-22 (7532)	0.821	0.929	0.889	1.000
	(0.386)	(0.262)	(0.333)	0.000
EA-6B (7543)	0.742	1.000	0.750	0.000
	(0.445)	0.000	(0.463)	(.)
KC-130 (7556/7557)	0.657	0.913	0.640	0.765
	(0.477)	(0.288)	(0.490)	(0.437)
CH-46 (7562)	0.538	0.795	0.429	0.607
	(0.499)	(0.406)	(0.498)	(0.493)
UH-1 (7563)	0.500	0.726	0.529	0.522
	(0.502)	(0.451)	(0.515)	(0.511)
CH-53D (7564)	0.542	0.786	0.667	0.500
	(0.504)	(0.426)	(0.488)	(0.527)
AH-1 (7565)	0.595	0.829	0.543	0.567
	(0.492)	(0.379)	(0.505)	(0.500)
CH-53E (7566)	0.594	0.800	0.604	0.485
	(0.492)	(0.404)	(0.494)	(0.508)
EA-6B (7588)*	0.681	0.828	0.400	0.750
	(0.470)	(0.384)	(0.548)	(0.463)
Observations	**1619**	**518**	**291**	**324**
Standard deviations in parentheses				

* Indicates NFO PMOS

c. Promotion Selection and Additional MOS

The Weapons and Tactics Instructor (WTI) MOS enjoyed a 20.6 ppt increase in selection rate compared to the overall aviation rate, as shown in Table 35 (82.4% vs. 61.8%), and a 30.3 ppt advantage compared to non-WTI aviators (82.4% vs. 52.1%). Additionally, the WTI selection rate of each PMOS group exhibited a marked

increase from its respective PMOS's overall average. This statistic, however, does not necessarily mean that promotion selection is linked to the WTI MOS by a causal relationship. Acceptance into the WTI program is competitive at the unit level, as each squadron commanding officer (CO) recommends only one to two pilots per semiannual WTI class. The pilots recommended by the CO are typically the top performers in the squadron and are recognized for having the potential for additional responsibility in flight leadership with the WTI MOS. Therefore, the attempt to establish causation between promotion selection and WTI suffers from selection bias, as the pilots with the WTI designation are likely to be selected for promotion anyway, with or without the additional MOS.

The Forward Air Controller (FAC) MOS, unlike WTI, is not necessarily a competitive program. The average squadron aviator is eligible for this additional MOS. As expected then, the FAC promotion selection rates closely resemble aviation's overall selection average, and the related PMOS rates (Table 35).

Like the FAC MOS, the Aviation Safety Officer (ASO) additional MOS follows the overall selection rate average (Table 35). Among the PMOSs, however, ASO selection rates exhibit wide variation, from 100% (7525) to 40% (7588). Unlike the WTI statistics, the ASO selection rates are inconsistent relative to their respective PMOS's overall average; i.e., some ASO rates are less than their PMOS average (AV-8, KC-130, CH-46, AH-1, and EA-6B*), while others are above their respective averages (F/A-18, F/A-18*, MV-22, EA-6B, UH-1, and CH-53D/E).

3. Performance

Prior performance is likely the most significant predictor of promotion. Regardless of MOS, experience, or any other seemingly important factor, Marine Corps officer promotion boards select the "best and most qualified" from the eligible pool. The FITREP is the, "…primary means of evaluating a Marine's performance and is the Commandant's primary tool for the selection of personnel for promotion…" (NAVMC 10835A, n.d.).

a. Performance Summary Statistics

The Reporting Senior Relative Value (RV) is the quickest and most direct method in describing Marines' performance. The scale of RV is from 80.0 to 100.0. RV is also broken down into three strata's. The upper stratum, or third, includes all in-zone officers with an average RV between 93.34 and 100. The middle stratum includes 86.67-93.33, and the lower stratum 80-86.66. Reviewing Officer Cumulative Value (ROCV) describes relative performance with regard to the amount of comparative assessment "tree" levels above (+) or below (-) the reviewing officers' cumulative average. Table 36 describes the summary statistics of the distribution of RV, ROCV, and RV. The mean RV of the in-zone sample was 90.79, and the RV middle strata described the largest proportion of O-4s at 61.3%. The mean ROCV of the in-zone sample was .063 "tree" levels above the ROs' averages.

Table 36. Performance Summary Statistics, by Sample

Variable	Mean		
	Full Sample	In-Zone Sample	Aviation Sample
RV	90.06	90.79	90.11
	(3.65)	(3.72)	(3.42)
RV Upper	0.184	0.250	0.172
	(0.388)	(0.433)	(0.378)
RV Middle	0.638	0.613	0.666
	(0.481)	(0.487)	(0.472)
RV Lower	0.176	0.135	0.159
	(0.381)	(0.342)	(0.366)
ROCV	-0.066	0.063	-0.035
	(0.50)	(0.50)	(0.48)
Observations	**8271**	**4208**	**1619**
Standard deviations in parentheses			

b. Promotion Selection and Performance

Tables 37 and 38 compare the promotion rate, by performance categories and occupational fields, for the in-zone sample.

Table 37. Promotion Rates by RV Strata and MOS

Variable	All MOS Sel Rate	Aviation Sel Rate	Infantry Sel Rate	Logistics Sel Rate	Othr MOS Sel Rate
RV Upper	0.870	0.839	0.902	0.885	0.869
	(0.337)	(0.369)	(0.298)	(0.320)	(0.338)
RV Middle	0.675	0.653	0.703	0.649	0.697
	(0.468)	(0.476)	(0.458)	(0.478)	(0.460)
RV Lower	0.295	0.236	0.458	0.342	0.313
	(0.457)	(0.426)	(0.503)	(0.481)	(0.465)
Observations	**4208**	**1619**	**616**	**345**	**1628**
Standard deviations in parentheses					

Table 37 demonstrates the sample's promotion selection relationship towards RV strata with regard to occupational field. The sample's overall behavior (i.e., "All MOSs") is generally consistent throughout the MOS groupings. The vast majority of officers in the upper RV strata, regardless of occupational group, were selected for promotion (83.9% and higher); a smaller majority from the middle strata (64.9% and higher), and only a minority of officers was selected from the lower strata (45.8% & lower). The difference between the MOS groups in selection, however, is the degree of majority or minority based on RV strata. The infantry MOS's middle strata had a 7.6% higher selection rate than aviation's middle strata (a difference of 5.0 ppts). Additionally, the distribution of selected to non-selected in the infantry's lower strata is nearly equal (45.8% to 54.2%, respectively), while aviation's lower strata "selected" is a vast minority (23.6% to 76.4%, respectively). Distribution alone, however, does not describe the performance factor adequately. The range within the individual RV strata allows for differentiated performance among competing Marines. The actual RVs, vice categorical representations in strata, need to be analyzed with regard to selection and occupational field. Table 38 describes the numerical average RV by MOS group.

Table 38. Average RV & ROCV Comparison, by Selection & MOS

Variable	All MOSs		Aviation		Infantry		Logistics		Other MOSs	
	Select	Non-Sel	Select	Non-Sel	Select	Non-Sel	Select	Non-Sel	Select	Non-Sel
RV	91.82	88.69	91.18	88.38	92.59	89.75	92.19	89.16	91.99	88.65
	(3.28)	(3.70)	(2.95)	(3.42)	(3.41)	(3.84)	(3.26)	(3.45)	(3.40)	(3.97)
ROCV	0.217	-0.253	0.132	-0.304	0.372	-0.115	0.243	-0.261	0.224	-0.229
	(0.44)	(0.48)	(0.41)	(0.45)	(0.47)	(0.46)	(0.45)	(0.44)	(0.43)	(0.52)
Obs	**2830**	**1378**	**1001**	**618**	**464**	**152**	**235**	**110**	**1130**	**498**
Standard deviations in parentheses										

The comparative analysis of FITREP relative values reveals that the aviation MOS had the lowest selection standard RV (91.18 in Table 38) of any MOS group, to include the fleet (91.82). The infantry MOS had the highest overall RV average (91.88, not shown), and the highest selection standard RV (92.59). These relative performance value differences, however, are slight. The aviator average RV in the selected category is only 1.5% different from the infantry, and 0.7% from the fleet average.

The FITREP relative value difference between MOS groups, though slight, begs the question of systematic differences in aptitude or evaluation standards between MOSs. However, the RV comparison is too broad of a measure to validate any assertion of this nature. Therefore, the FITREP Attribute Relative Value (ARV) is used to investigate micro-differences in MOS groups across all FITREP attributes in Appendix A. Twelve of the fourteen FITREP attributes are analyzed in Appendix A for MOS comparison. The overall results of the ARV analysis by MOS reveal only miniscule differences between MOSs among the FITREP attributes.

The final descriptive statistic of the FITREP performance category is the Reviewing Officer Cumulative Value (ROCV). The aviation MOS's ROCV performance relative to the other MOS groups is demonstrated in Table 38. Aviation's "selected" ROCV of 0.132 is 64.4% lower than the fleet "selected" average ROCV, and 81.8% lower than infantry. The selected for promotion officers of the aviation MOS averaged 13.2% of one "tee" level above their RO's cumulative average, while non-selected

aviators averaged 30.4% of one level below the average. In comparison, the infantry MOSs selected for promotion category averaged 37.2% of one "tree" level above their RO's cumulative average. Aviation had the lowest average ROCV relative to the other MOS groups, for both selection categories.

4. Training and Education

The next set of statistics describes promotion outcomes with regard to career path enhancing choices and opportunities in training and education. The education choices analyzed include Professional Military Education (PME) and Fully-Funded Graduate Education. Marksmanship, martial arts, and physical fitness are the training variables analyzed.

a. Training and Education Summary Statistics

Table 39 presents the education summary statistics. The majority of the in-zone sample is educated to the bachelor's degree level (62.5%), and most Marines completed Intermediate Level School (ILS), which is the appropriate level Professional Military Education (PME) requirement for the grade of O-4 (89.4%). Relatively few O-4s of the study's samples participated in the Fully-Funded Graduate Education programs. Overall, only 6.2% of in-zone candidates participated in FFGE; of these, the largest proportion attended the Naval Postgraduate School in Monterey California (85.5%, or 5.3% of the in-zone sample).

Table 39. Education Summary Statistics, by Sample

Variable	Mean		
	Full Sample	In-Zone Sample	Aviation Sample
HS Deg	0.007	0.007	0.007
	(0.085)	(0.083)	(0.082)
Bachelor's Deg	0.626	0.625	0.755
	(0.484)	(0.484)	(0.430)
Master's Deg	0.332	0.339	0.235
	(0.471)	(0.473)	(0.424)
PM/PhD	0.035	0.030	0.004
	(0.183)	(0.171)	(0.061)
PME Complete	0.899	0.894	0.912
	(0.301)	(0.308)	(0.283)
Resid. USMC	0.090	0.125	0.121
	(0.286)	(0.331)	(0.326)
Nonresident	0.720	0.664	0.701
	(0.449)	(0.473)	(0.458)
Resid. Other	0.088	0.104	0.090
	(0.283)	(0.306)	(0.287)
FFGE Any Institution	0.072	0.062	0.038
	(0.259)	(0.242)	(0.191)
NPS	0.062	0.053	0.028
	(0.241)	(0.224)	(0.164)
AFIT	0.006	0.005	0.009
	(0.079)	(0.071)	(0.093)
Civ. Univ	0.004	0.004	0.001
	(0.061)	(0.065)	(0.035)
Observations	**8271**	**4208**	**1619**
Standard deviations in parentheses			

The training summary statistics are presented in Table 40. The majority of sampled officers had qualified as experts in marksmanship, though, a larger proportion qualified as experts in the rifle compared to the pistol (approximately 84% compared to 63%). This increase in rifle experts, however, is most likely due to the design of the marksmanship variables. Officers are not required to re-qualify in the rifle, but are required to re-qualify annually with the pistol. Therefore, the rifle expert variable

indicates whether an officer had ever earned an “expert” qualification prior to the rank of major (O-4), whereas the pistol variable indicates the most current pistol qualification. With regard to MCMAP, slightly less than half of each sample had qualified to the tan belt level. However, only 3.8% of in-zone officers had qualified above the tan belt level, and only 1.7% within the aviation sample. Finally, over 95% of all sampled O-4s averaged a first-class PFT, and over 90% were within the defined Marine Corps height and weight standard.

Table 40. Training Summary Statistics, by Sample

Variable	Mean		
	Full Sample	In-Zone Sample	Aviation Sample
Marksmanship:			
Rifle Exprt	0.838	0.848	0.843
	(0.368)	(0.359)	(0.364)
Pistol Exprt	0.626	0.635	0.643
	(0.484)	(0.482)	(0.479)
MCMAP:			
Tan Belt	0.454	0.444	0.417
	(0.498)	(0.497)	(0.493)
Gray Belt & Abv	0.032	0.038	0.017
	(0.176)	(0.190)	(0.128)
Physical Fitness & Military Appearance:			
Avg PFTscore	246.4	252.6	249.6
	(31.220)	(29.375)	(28.699)
PFT 1stClass	0.958	0.967	0.964
	(0.200)	(0.180)	(0.186)
PFT 2ndClass	0.042	0.033	0.036
	(0.200)	(0.179)	(0.186)
Height (inches)	70.6	70.7	70.9
	(2.696)	(2.692)	(2.443)
Weight (lbs)	181.8	181.4	182.3
	(19.976)	(19.632)	(17.937)
Ht/Wt Stan	0.910	0.925	0.936
	(0.286)	(0.264)	(0.245)
BodyFat Standard	0.086	0.073	0.064
	(0.281)	(0.259)	(0.245)
BCP	0.004	0.003	0.000
	(0.060)	(0.053)	0.000

Observations	**8271**	**4208**	**1619**
Standard deviations in parentheses			

b. Promotion Selection and PME / FFGE

The promotion selection percentage of O-4s who completed appropriate level PME, among the available curriculums, is displayed in Table 41. The Marine Corps' resident ILS institution, Command & Staff College (CSC), has the highest selection percentage of the other PME categories, across most MOS groups; 85.9% of all sampled officers that attended resident Marine CSC were selected for promotion. The infantry community had the highest resident selection percentage; 97.8% of infantry officers who completed ILS at CSC were selected for promotion. Aviation's resident USMC selection percentage is the lowest among the other MOS groups; 79.1% of aviators who attended resident CSC were selected for O-5. The non-resident curriculums have the lowest selection percentage across all MOS groups. The natural conclusion from these statistics may be that resident PME is a strong determinant for promotion selection. However, acceptance to any of the resident ILS programs (Marine Corps or other) is attained by selection from a competitive board of senior Marine officers. Like a promotion selection board, the PME board screens candidate Marines' records for the best officers to fill resident PME school seats. This competition factor for resident school seats indicates the likelihood of selection bias inherent to the PME completion and promotion selection comparison. Those officers selected for resident PME were also likely to be selected for promotion, because of the strength of their performance and other factors within their records.

Table 41. PME/FFGE & Selection, by MOS Group

Variable	All MOS Sel Rate	Av Sel Rate	Inf Sel Rate	Log Sel Rate	OthrMOS Sel Rate
PME Complete	0.713	0.653	0.781	0.741	0.743
	(0.452)	(0.476)	(0.414)	(0.439)	(0.437)
Resid. USMC	0.859	0.791	0.979	0.920	0.856
	(0.348)	(0.408)	(0.146)	(0.274)	(0.352)
Nonresident	0.671	0.612	0.743	0.689	0.704
	(0.470)	(0.488)	(0.438)	(0.464)	(0.457)
Resid. Other	0.806	0.788	0.735	0.766	0.860
	(0.396)	(0.410)	(0.445)	(0.428)	(0.348)
FFGE Any Institution	0.538	0.393	0.556	0.619	0.582
	(0.500)	(0.493)	(0.506)	(0.498)	(0.495)
NPS	0.538	0.311	0.565	0.619	0.597
	(0.500)	(0.468)	(0.507)	(0.498)	(0.492)
AFIT	0.571	0.643	0.000	.	0.500
	(0.507)	(0.497)	(.)	(.)	(0.548)
Civ. Univ	0.500	0.500	0.667	.	0.462
	(0.515)	(0.707)	(0.577)	(.)	(0.519)
Observations	**4208**	**1619**	**616**	**345**	**1628**
Standard deviations in parentheses					

The Fully-Funded Graduate Education (FFGE) opportunity, though appealing to prospective participants, represents a divergence from the nominal Marine *warfighter* career track. The dataset, however, does not allow an in-depth analysis of this variable as only 6.2% of the in-zone officers participated in the FFGE program. But the sample provides insightful descriptive statistics regarding FFGE for the aviation MOS, as shown in Table 41; only 39.3% of aviation FFGE participants were selected for promotion, while the fleet averaged 53.8%. The officers of the comparison MOS groups who participated in FFGE also fared better than aviation in promotion selection.

c. Promotion Selection and Training

Table 42 presents the statistical relationship between Marine Corps training qualifications and promotion to O-5. The emphasis of analysis, however, is on

the military appearance aspect of Marine Corps physical fitness. Many prior USMC promotion studies have included the marksmanship and Physical Fitness Test (PFT) in statistical research, but few have attempted to measure appearance and its behavior with respect to promotion probability. Therefore, detailed descriptive statistics on PFT and selection are ignored until later chapters. With regard to military appearance, however, the sample shows that 92.5% of in-zone Marines met the defined height/weight standard (Table 40), of which 68.5% were selected for promotion (Table 42). This selection rate was higher than the overall selection rate of 67.3%. Those Marines that did not meet the height/weight standard, but did meet the next echelon of appearance standard (Body Fat), selected at only 51.5%. Marines that met the height/weight standard selected at a higher rate than those that did not, across all MOS groups. Also, the selection rate of the height/weight standard category within each MOS group was higher than that MOS's overall selection rate. Caution must be exercised in attributing promotion selection likelihood directly to being a "fitter" Marine. Instead, better physical fitness and adherence to height/weight standards may be indicative of higher performing Marines, who by nature of their performance are more likely to be selected for promotion.

Table 42. Training Qualifications & Selection, by MOS Group

Variable	All MOS Sel Rate	Avn Sel Rate	Inf Sel Rate	Log Sel Rate	Othr MOS Sel Rate
Rifle Exprt	0.686	0.632	0.765	0.701	0.705
	(0.464)	(0.483)	(0.424)	(0.459)	(0.456)
Pistol Exprt	0.689	0.617	0.791	0.722	0.711
	(0.463)	(0.486)	(0.407)	(0.449)	(0.454)
Tan Belt	0.672	0.615	0.723	0.701	0.700
	(0.470)	(0.487)	(0.449)	(0.459)	(0.459)
Gray Belt & Abv	0.734	0.593	0.882	0.500	0.721
	(0.443)	(0.501)	(0.325)	(0.522)	(0.452)
Avg PFTscore	***257.4***	***254.1***	***267.3***	***257.6***	***256.2***
	(26.935)	(27.085)	(23.774)	(25.173)	(27.459)
PFT 1stClass	0.684	0.628	0.759	0.698	0.708
	(0.465)	(0.484)	(0.428)	(0.460)	(0.455)
PFT 2ndClass	0.350	0.362	0.400	0.182	0.361
	(0.479)	(0.485)	(0.516)	(0.405)	(0.484)
Height (inches)	***70.7***	***71.0***	***71.2***	***70.3***	***70.4***
	(2.666)	(2.362)	(2.621)	(3.051)	(2.789)
Weight (lbs)	***181.0***	***181.9***	***185.4***	***178.2***	***179.0***
	(19.147)	(17.367)	(18.434)	(21.069)	(20.148)
Ht/Wt Stan	0.685	0.632	0.765	0.698	0.707
	(0.464)	(0.482)	(0.425)	(0.460)	(0.455)
BodyFat Standard	0.515	0.414	0.649	0.552	0.530
	(0.501)	(0.495)	(0.482)	(0.506)	(0.501)
BCP	0.500	.	0.500	0.000	0.625
	(0.522)	(.)	(0.707)	0.000	(0.518)
Observations	**4208**	**1619**	**616**	**345**	**1628**
Standard deviations in parentheses					

Note: Bold values indicate average values for selected O-5s (PFT, height, and weight)

5. Experience

Career path choices and opportunities are certainly related to occupational experience in MOS; however, the next set of variables captures nuances that general occupational field, aircrew designation, and primary/additional MOS do not capture.

Summary statistics of experience within all study samples is analyzed, and promotion selection behavior is presented with particular emphasis on the aviation occupational field.

a. Combat Experience Summary Statistics

The summary statistics of combat deployment experience are displayed in Table 43. Distributions and mean values of combat experience are relatively similar among all three samples. Within the in-zone sample, 38.7% of eligible officers had been evaluated in a combat FITREP covering 180 days or more as an O-4, which is indicative of a 6-month combat deployment for the study. Also within the in-zone sample, 35.8% had deployed to Iraq and 7.2% to Afghanistan in the current rank/grade (major/O-4). The aviation distribution of combat deployments includes 30% that deployed only once, and 12.9% deployed twice or more.

Table 43. Combat Deployment Summary Statistics

Variable	Mean		
	Full Sample	In-Zone Sample	Aviation Sample
CombatRpt(binary)	0.384	0.387	0.428
	(0.486)	(0.487)	(0.495)
1 CombatRpt	.263	.2745	.2996
	(.4403)	(.4463)	(.4582)
2 CombatRpts	.095	.0932	.1038
	(.2933)	(.2907)	(.3051)
3+CombatRpts	.0256	.0195	.0247
	(.158)	(.1382)	(.1553)
Combat Months	3.159	2.966	2.763
	(4.844)	(4.552)	(4.279)
Deployed to Iraq	0.357	0.358	0.354
	(0.479)	(0.479)	(0.478)
Deployed to Afghan.	0.076	0.072	0.056
	(0.266)	(0.258)	(0.230)
Observations	**8271**	**4208**	**1619**
Standard deviations in parentheses			

b. Squadron Experience Summary Statistics

The level of aviator PMOS proficiency is measured within the study by having completed a FITREP-evaluated flying squadron assignment as a major (O-4) that corresponds to the Marine's PMOS. The sample indicates that only 52.9% of the aviation community completed a squadron assignment in the rank of major as shown in Table 44. Additionally, the amount of "time in the cockpit" is measured in months at the squadron, and expressed as a ratio of squadron time to time-in-grade (TIG). The average amount of time spent in the squadron as O-4s was 23.2 months, or 40.4% of their time as majors ("Sqdrn:TIG" variable). Finally, a combined 5.0% of the sampled aviators held squadron department head billets as Operations Officer or Maintenance Officer.

Table 44. Aviation PMOS Experience Summary Statistics

Variable	Aviation Sample Mean
Sqdrn Tour	0.529
	(0.499)
Sqdrn DeptHd	0.052
	(0.222)
Sqdrn OpsO	0.027
	(0.161)
Sqdrn MO	0.025
	(0.157)
Sqdrn:TIG	0.404
	(0.252)
Sqdrn Mo.s	23.2
	(14.591)
Observations	**1619**
Standard deviations in parentheses	

c. Promotion Selection and Combat Experience

The *warfighter* ethos of the Marine Corps coupled with the "every Marine to the fight" directive of General James T. Conway, 34th Commandant, lends to the analysis of selection rate by quantity of deployments to a combat zone (ALMAR 002/07,

January 23, 2007). Differences in promotion selection rates are displayed in the following analysis with respect to differing experience levels in combat deployment(s), and squadron experience for aviators.

The promotion selection rates of in-zone eligible officers who had deployed increased 5.6 ppts from the overall average (72.9% vs. 67.3%) as shown in Table 45. Additionally, selection rates increased with successive deployments up to three or more, for the in-zone and aviation samples; e.g., in-zone selection rate increased from 71.3% to 82.9%.

Deployments described in geographic terms also yielded interesting selection behavior statistics. Officers that had deployed to Iraq and Afghanistan had higher promotion selection rates than the overall average selection rates. In-zone officers that had deployed to Iraq had a 5.7 ppt higher selection rate than the average (73.0% vs. 67.3%). The Afghanistan increase in selection rate was slightly less at 2.5 ppts.

Table 45. Combat Deployments and Selection Rates

Variable	Full Sample Sel Rate	In-Zone Sample Sel Rate	Aviation Sample Sel Rate
CombatRpt(binary)	0.409	0.729	0.697
	(0.492)	(0.445)	(0.460)
1 CombatRpt	.411	.7126	.668
	(.4921)	(.4528)	(.4714)
2 CombatRpts	.4071	.7551	.744
	(.4916)	(.4306)	(.4377)
3+CombatRpts	.4009	.8293	.85
	(.4912)	(.3786)	(.3616)
Deployed to Iraq	0.406	0.730	0.691
	(0.491)	(0.444)	(0.462)
Deployed to Afghan.	0.377	0.698	0.637
	(0.485)	(0.460)	(0.483)
Combat Mo.s	***3.236***	***3.137***	***3.063***
	(4.667)	(4.565)	(4.409)
Observations	**8271**	**4208**	**1619**
Standard deviations in parentheses			

d. Promotion Selection and Squadron Experience

Table 46 describes the aviation samples' selection rates with regard to having completed a squadron tour and/or a department head billet (i.e., OpsO or MO). The table also describes average values of squadron experience measured by time with regard to selection. In-zone aviators that completed at least one squadron assignment as an O-4 had only a 0.6 ppt increase in selection rate over the sample average (62.4% vs. 61.8%). Additionally, those officers selected to O-5 averaged 2.0 more evaluated months in a squadron assignment than the sample average (25.2 months vs. 23.2 months). With regard to squadron department head billets, those aviators that completed either an OpsO or MO billet had an increased selection rate of 2.5 ppt. The aggregate increase in department head selection rate, however, is most likely attributed to MO billet because the OpsO selection rate was actually below the sample selection average (55.8% vs. 61.8%).

Table 46. Squadron Experience & Selection

Variable	**Aviation Sel Rate/Mean**
Sqdrn Tour	0.624
	(0.485)
Sqdrn DeptHd	0.643
	(0.482)
Sqdrn OpsO	0.558
	(0.503)
Sqdrn MO	0.732
	(0.449)
Sqdrn:TIG	***0.440***
	(0.246)
Sqdrn Mo.s	***25.2***
	(14.238)
Observations	**1619**
Standard deviations in parentheses	

D. SUMMARY

Analysis of descriptive statistics validates the assertion of the study's sponsor to some degree. The aviation occupational field suffered from an overall lower promotion selection rate to O-5 compared to other MOS groups during the promotion fiscal years of 2004-2012. However, the aviation MOS promotion rate is trending positively over the last nine promotion boards. In comparison to the sponsor's named other "large population" MOS groups, however, aviation performed both better and worse. Compared to the logistics MOS, aviation is trending better in selection rate (+0.72 ppts/year), but trails the infantry (-0.70 ppts/year). With respect to overall in-zone sample average, the aviation MOS had the lowest selection rate of the three comparison MOS groups. Aviation trailed logistics by 6.3 ppts, and infantry by 13.5 ppts, in overall sample selection rate.

Analysis into the nature of systematic differences of occupational fields in selection behavior, revealed the presence of consistent promotion factors across all MOSs. The Marine Corps' promotion ethos of "best and most qualified" regardless of race, creed, or MOS, is confirmed in the sample's descriptive statistics. Those who performed better in FITREP evaluations (upper RV strata, Table 37) had higher selection rates than those who performed worse. Analysis into individual performance, however, revealed that the aviation MOS's average performance was below infantry and logistics. Furthermore, deeper analysis of FITREP ARVs revealed that aviation consistently fell below the other MOS groups in specific evaluated areas, but only slightly (Appendix A). It is uncertain whether the exhibited lower performance of aviators on FITREP evaluations was due to higher evaluative standards of aviation reporting seniors and reviewing officers or truly lower performance. The "normalizing" aspect of the RV, ARV, and ROCV metrics may indicate the latter.

Finally, analysis conducted on the restricted aviation-only sample revealed consistent factors associated with those aviators of higher and lower promotion selection rates. Aviators who had attained the WTI additional MOS exhibited far higher selection rates than those without WTI. Additionally, those aviators who spent more of their time

as O-4s in a squadron assignment, and in combat deployments, had higher selection rates than those with less time in the squadron and deployed. Some colloquial notions regarding aviator promotion success, however, were not confirmed in the squadron tour and squadron department head billet analysis. Over 60% of those aviators who completed at least one squadron tour as an O-4 were not selected for O-5. Additionally, completion of a squadron Operations Officer assignment was indicative of a lower selection rate than the overall aviation average (Table 46).

The following chapters continue the analysis of the promotion selection behavior of Marine officers to the grade of O-5, but with different methods. Regression analysis will be used to conduct multivariate analysis of all promotion factors within the same model.

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VII. MULTIVARIATE ANALYSIS METHODS

> Law and implementing regulations strictly govern the type of information that can be provided for consideration to selection boards…The MBS (master brief sheet) is a factual summary of the OMPF and is used as a tool by board members to assist in reviewing an officer's record.
>
> -USMC Promotion Manual, Vol. 1, 3-4

A. INTRODUCTION

The preliminary statistical analysis of the previous chapter has only limited explanatory power in answering the study's research questions. Officer promotion probability was examined with respect to only one independent factor, or category of factors, at a time (performance, experience, etc). This approach, though helpful in understanding relationships between proposed promotion predictors and selection, does not examine the effect of a focus variable, such as occupational field, while holding constant the other important predictors of promotion. In reality, officers are selected for promotion to O-5 based upon the attractiveness of the aggregate effect of all of their individual qualifications, as illustrated in text and by photograph within their personal Master Brief Sheets (MBS). The multivariate statistical models attempt to estimate the aggregate effect of all of the explanatory variables on the probability of promotion selection to lieutenant colonel.

B. THEORETICAL MODEL

The probit model is the statistical model chosen to estimate the effects of the hypothesized predictors. The probit model is appropriate because the dependent variable is binary, representing either being selected or not selected for promotion. The dependent variable is expressed in terms of the probability of the binary response, dependent upon the function of the explanatory variables (i.e., promotion factors, Figure 24). The probit model is based on the normal distribution of the cumulative density function (CDF), which coupled with the binary response dependent variable, provides the maximum likelihood estimation (MLE) dependent upon the distribution of y given x (Wooldridge,

2009, p. 578). Partial effects of each variable are estimated for interpretation of the promotion effect of each explanatory variable. Figure 24 shows the probit statistical model.

Binary Response Probit Model:

$$P(y=1|x)=G(\beta_0 + \beta x)$$

Function of the Probit Model, the Normal CDF:

$$G=\Phi(z)$$

Figure 24. Probit Statistical Model

C. ECONOMETRIC MODEL

The promotion factors are organized into the six categories as explained in Chapter V and serve as the model's explanatory variables expressed as a function of the normal CDF. Figure 25 shows the basic econometric model with the dependent variable, promotion selection, and the six categories of explanatory variables.

$$P(\text{promotion selection})=G(\beta_0 + \beta\,\text{MOS} + \beta\,\text{performance} + \beta\,\text{training \&}$$
$$\text{education} + \beta\,\text{experience} + \beta\,\text{demographics} + \beta\,\text{promotion board})$$

Figure 25. Econometric Model

1. Modeling Setup

The econometric model is applied to three related datasets in order to estimate the effect of the explanatory variables. The first estimation is conducted on the full sample (n=8,271), which provides an initial statistical result across the largest number of

observations. The next estimation is conducted on the restricted in-zone sample (n=4,208), providing sensitivity testing of the initial "aviator" estimator from the full sample and analyzing the study's secondary research question—does the effect of being an aviator vary by individual characteristics among the independent variables? Reserving the promotion factors analysis for the in-zone sample provides greater statistical fidelity as the difference in promotion selection rate between in-zone and above-zone officers is 61.9 ppts, and nearly half of the full sample is composed of above-zone O-4s. The final model uses the restricted aviation-only sample (n=1,619), and focuses further analysis on the secondary research question—does the probability of promotion vary between aviators based upon individual characteristics specific to the aviation community? The base officer of the following models is described as follows:

- White male, unmarried, with zero dependents
- Other MOS (non-aviation/infantry/logistics), and not designated a "critically short" MOS
- High school degree, commissioned from an "other" source (i.e., inter-service transfer, Army ROTC, etc.)
- Non-PME complete for grade, non-expert in rifle/pistol marksmanship, and no MCMAP belt qualification
- Within height/weight standard, PFT 2nd class or below, and average numerical height/weight
- Lower strata in average FITREP Relative Value (80.0-86.66 RV) or an average cumulative RV (when comparing with the continuous variable), with an average Reviewing Officer Cumulative Value (ROCV)
- No combat deployment experience in grade O-4
- In-zone for promotion to O-5 during the FY2012 promotion board[15]

[15] Only applicable to the full sample model.

a. Full Sample Model

The full sample econometric model analyzes the study's primary research question; does the probability of promotion vary by occupational field (or MOS), holding all other factors fixed? Two models specifications are estimated on the full sample.

Each model has representative variables from each category of explanatory variables. Model 1 is the most basic model and applies the two main comparative groups of the MOS category (infantry and logistics). The training and education category is proxied by the entire set of civilian education and commissioning source variables, marksmanship qualification, and PFT indicator variables. The RV continuous variable is the only performance variable. The experience variable is proxied by the binary combat report variable, indicating a 180-day combat deployment or not. Model 1 also includes the entire set of demographic variables. Figure 26 shows the specification of Model 1.

$$P(\textbf{promotion selection}) = G\{\beta_0 + \beta\,\textbf{MOS}(\text{aviation, infantry, logistics}) + \beta\,\textbf{performance}(\text{RV}) + \beta\,\textbf{training \& education}(\text{civilian educ., comm. source, marksmanship, PFT}) + \beta\,\textbf{experience}(\text{combat report binary}) + \beta\,\textbf{demographics} + \beta\,\textbf{promotion board}\}$$

Figure 26. Model 1, Full Sample

The specification of Model 2 is more refined than that of Model 1 (see Figure 26). Model 2 adds the critical MOS variable, the indicators of PME and FFGE, MCMAP, and the military appearance variables. Model 2 also further refines performance by replacing the RV continuous variable with RV strata indicators (upper and middle) and the ROCV. Finally, Model 2 specifies combat experience with the deployment quantity and geographic location indicators. Figure 27 shows the specification of Model 2.

$P($**promotion selection**$)=G\{\beta_0 + \beta$ **MOS**(aviation, infantry, logistics, crit.MOS) + β **performance**(RV strata, ROCV) + β **training & education**(civilian educ., comm. source, PME, FFGE, marksmanship, MCMAP, PFT, mil. appearance) + β **experience**(combat report qty, Iraq/Afghan deploy) + β **demographics** + β **promotion board**$\}$

Figure 27. Model 2, Full Sample

b. In-Zone Model

The in-zone models represent the main statistical analysis of the chapter. The in-zone models estimate the effects of various hypothesized effects, while holding constant the occupational field variables. This set up helps to answer the secondary research question regarding varying effects of the aviator MOS on selection based on individual characteristics. Also, the estimates of the earlier full sample models are tested in sensitivity analysis with a restricted sample and varying model specifications. Five different models are applied to the in-zone sample, with varying degrees of specificity.

Models 1 and 2 are the same models applied to the full sample, with the same specifications respectively (Figures 26 and 27). These models applied to the in-zone sample provide sensitivity analysis of the estimated effects found in the full sample. Models 1 and 2 also represent the basic models of the in-zone sample. Greater specification is applied in Models 3 through 5.

Model 3 is the same as Model 2 with further specification of the PME and FFGE variables. The PME and FFGE variables are broken down into categories based on institution or curriculum. Also, the military appearance variables are augmented with the height and weight continuous variables. Figure 28 shows the specification of Model 3.

$P($**promotion selection**$)=G\{\beta_0 + \beta$ **MOS**(aviation, infantry, logistics, crit.MOS) + β **performance**(RV strata, ROCV) + β **training & education**(civilian educ., comm. source, PME curriculum, FFGE institution, marksmanship, MCMAP, PFT, mil. appearance) + β **experience**(combat report qty, Iraq/Afghan deploy) + β **demographics** + β **promotion board**$\}$

Figure 28. Model 3, In-Zone Sample

Model 4 is a hybrid between Models 1 and 2 with additional MOS refinement. In particular, three additional occupational fields are split from the reference MOS category: Intelligence (02XX), artillery (08XX), and communications (06XX) are the next largest MOS groups behind aviation, infantry, and logistics. Adding additional MOS groups is intended to provide a more refined estimate of the aviation MOS effect on promotion compared to other occupational fields. In addition, the critical MOS variable is dropped from Model 4, and the PME and FFGE variables revert to indicators of participation only. The MCMAP variables are also dropped, as well as the height and weight continuous variables. Finally, the performance category is represented by the RV continuous variable only. Figure 29 shows the specification of Model 4.

$P($**promotion selection**$)=G\{\beta_0 + \beta$ **MOS**(aviation, infantry, logistics, artillery, intelligence, communications) + β **performance**(RV) + β **training & education**(civilian educ., comm. source, PME, FFGE, marksmanship, PFT, mil. appearance) + β **experience**(combat report qty, Iraq/Afghan deploy) + β **demographics** + β **promotion board**$\}$

Figure 29. Model 4, In-Zone Sample

Model 5 is the most comprehensive model of the in-zone sample. Model 5 adds the additional MOSs from Model 4 to the specification of Model 3. Figure 30 shows the specification of Model 5.

$P($**promotion selection**$)=G\{\beta_0 + \beta$ **MOS**(aviation, infantry, logistics, artillery, intelligence, communications, crit.MOS) + β **performance**(RV strata, ROCV) + β **training & education**(civilian educ., comm. source, PME, FFGE, marksmanship, MCMAP, PFT, mil. appearance) + β **experience**(combat report qty, Iraq/Afghan deploy) + β **demographics** + β **promotion board**$\}$

Figure 30. Model 5, In-Zone Sample

c. Aviation Model

The aviation models explore the competitive nature for promotion selection among the aviators. The aviation models analyze the secondary research question: What are the significant promotion predictors within the aviation MOS? Unlike the full and in-zone samples which analyzed only one key variable of interest, the models of this section analyze several different dimensions of the aviation MOS. The following models explore the possibility of differences in promotion outcomes between designated aviators and Naval Flight Officers (NFO), fixed-wing and rotary-wing communities (FW/RW), and between aviation Primary Military Occupational Specialties (PMOS). Two promotion explanatory variable categories are condensed because of smaller aviation sample. The civilian education variable is condensed to only three categories (high school degree, bachelor's degree, and master's degree and above). The military appearance variable is condensed to two categories (height/weight standard and body fat standard) because there are no observations with "BCP" in the sample. The base officer of the aviation models is the same as listed previously, with the exception of MOS. The models differentiate between types of aviation MOS qualifications, and the base aviation officer is as follows:

- Model 1 estimates the promotion probability effects of an NFO vs. a designated naval aviator
- Model 2 estimates the promotion probability effects of the fixed-wing versus rotary-wing community (i.e., helicopter).
- Model 3 estimates the promotion effects of aviation PMOSs (with the CH-46E pilot as the reference group)

The base officers of the aviation models represent the respective majorities within the aviation community comparisons. Designated naval aviators, rotary-wing pilots, and CH-46E pilots represent the majority when analyzing the sample from the perspective of aircrew designation, aircraft –type communities, and PMOS, respectively.

Three models are estimated for the aviation sample in order to test three different sets of key variables. Model 1 estimates the promotion probability effects of NFOs versus designated naval aviators, while Model 2 compares the fixed-wing versus rotary-wing community, and Model 3 estimates the promotion effects of aviation PMOSs. With the exception of the key variables of interest, all three aviation models are specified the same.

The aviation model specifications are as follows. The MOS category is augmented with the additional MOS variables of WTI, FAC and ASO. The performance category includes the RV strata indicators, ROCV, and personal awards. The training and education category includes all civilian education, commissioning source, PFT and military appearance variables, marksmanship, and MCMAP. The experience category of includes the combat report quantity indicators, geographic deployment location, and squadron experience variables. Figures 31-33 show the specifications of the aviation models.

$P($**promotion selection**$)=G\{\beta_0 + \beta$ **MOS**(NFO, crit.MOS, WTI, FAC, ASO) + β **performance**(RV strata, ROCV, personal awards) + β **training & education**(civilian educ., comm. source, PME, FFGE, marksmanship, MCMAP, PFT, mil. appearance) + β **experience**(combat report, IZ/AF deploy, squadron) + β **demographics** + β **promotion board** $\}$

Figure 31. Model 1, Aviation Sample

$P($**promotion selection**$)=G\{\beta_0 + \beta$ **MOS**(fixed-wing community, crit.MOS, WTI, FAC, ASO) + β **performance**(RV strata, ROCV, personal awards) + β **training & education**(civilian educ., comm. source, PME, FFGE, marksmanship, MCMAP, PFT, mil. appearance) + β **experience**(combat report qty, Iraq/Afghan deploy, squadron) + β **demographics** + β **promotion board**$\}$

Figure 32. Model 2, Aviation Sample

$P($**promotion selection**$)=G\{\beta_0 + \beta$ **MOS**(PMOSs, crit.MOS, WTI, FAC, ASO) + β **performance**(RV strata, ROCV, personal awards) + β **training & education**(civilian educ., comm. source, PME, FFGE, marksmanship, MCMAP, PFT, mil. appearance) + β **experience**(combat report qty, Iraq/Afghan deploy, squadron) + β **demographics** + β **promotion board**$\}$

Figure 33. Model 3, Aviation Sample

D. SUMMARY

The study's multivariate analysis employs statistical models in order to isolate the effects of the aviation MOS in order to answer the key research questions. The theoretic probit estimation model is chosen to design an econometric model, which explores promotion selection effects. The binary response variable, "promotion selection to O-5," is the dependent variable of all study models. Six categories of explanatory variables are leveraged to build several different models of varying specificity. Finally, the econometric models are applied to three different samples: full, in-zone, and aviator. The following chapter explains the multivariate analysis statistical results.

VIII. MULTIVARIATE ANALYSIS RESULTS

A. MODEL RESULTS

The models' statistical results are analyzed with regard to the study's research questions and the three samples within which the models are tested. Particular consideration is given to statistically significant and practically significant estimators of promotion effects on selection probability. Additionally, the statistical robustness of estimators is discussed through sensitivity analysis in different model specifications and sample composition.

1. Full Sample Models

The results of the full sample models are displayed in Table 47. Many statistically and practically significant estimates are discovered in both model specifications. The key variable of interest, the aviation MOS, is statistically significant at the 5% level in both models. The aviation effect is also practically significant as it represents a difference in the promotion probability of 3.7 and 3.2 percentage points (ppts), respectively, in Models 1 and 2, holding other factors fixed; the average promotion rate in the full sample is 36.9%. Not surprisingly, the "above zone" indicator shows a lower promotion probability of over 60 ppts compared to the in-zone candidates ($p<0.01$). Additionally, statistically significant estimates are present in each of the explanatory variable categories, which indicate validity of the general model. Detailed analysis of the coefficients is reserved for the in-zone sample's models.

Table 47. Probit Promotion Model Partial Effects Results, Full Sample

Variable	Model 1	Model 2
Dependent Variable		
Promotion Select		
Explanatory Variable Categories		
Key Variable of Interest:		
Aviation	-0.037**	-0.032**
	(0.014)	(0.015)
Military Occupational Specialty		
Infantry	0.017	-0.003
	(0.020)	(0.020)
Logistics	-0.019	0.004
	(0.023)	(0.024)
CriticalMOS		0.048**
		(0.023)
Performance		
FITREP Evaluations:		
Rel. Value	0.045***	
	(0.002)	
RV Upper		0.230***
		(0.029)
RV Middle		0.126***
		(0.017)
ROCV		0.338***
		(0.016)
Training & Education		
Civilian Education:		
Bachelor’s Deg	0.186***	0.114
	(0.071)	(0.077)
Master’s Deg	0.293***	0.198**
	(0.088)	(0.092)
PM/PhD	0.299***	0.214*
	(0.105)	(0.112)
Commissioning Source:		
OCC	0.039	0.045
	(0.029)	(0.030)
PLC	0.052**	0.056**
	(0.025)	(0.026)
NROTC	0.017	0.034
	(0.027)	(0.028)
NavAcadmy	0.036	0.043
	(0.030)	(0.030)
Enlisted Program	-0.043	-0.018
	(0.030)	(0.032)
Professional Military Education:		
PME Complete		0.199***
		(0.012)
Fully-Funded Graduate Education:		
FFGE Any		-0.123***

		(0.018)
Marksmanship:		
Rifle Exprt	0.022	0.023
	(0.016)	(0.016)
Pistol Exprt	0.024*	0.026**
	(0.013)	(0.013)
MCMAP:		
Tan Belt		-0.004
		(0.013)
Gray Belt & Abv		0.015
		(0.036)
Physical Fitness & Military Appearance:		
PFT 1stClass	0.150***	0.122***
	(0.022)	(0.023)
BodyFat Standard		-0.068***
		(0.024)
BCP		0.031
		(0.132)
Height		0.009**
		(0.004)
Weight		-0.001
		(0.001)
Experience		
CombatRpt(binary)	0.110***	
	(0.014)	
1 CombatRpt		0.065***
		(0.017)
2 CombatRpts		0.095***
		(0.027)
3+CombatRpts		0.201***
		(0.052)
IZ Deploy		0.073***
		(0.017)
AF Deploy		0.037
		(0.025)
Demographics		
Female	0.133***	0.137**
	(0.051)	(0.056)
Black	-0.063***	-0.015
	(0.023)	(0.026)
Hispanic	-0.024	0.022
	(0.028)	(0.031)
Other Race	-0.028	-0.033
	(0.022)	(0.022)
Married	0.055**	0.045**
	(0.021)	(0.022)
Dependents	-0.001	0.002
	(0.005)	(0.005)
Promotion Zone		
Above-Zone	-0.609***	-0.608***
	(0.009)	(0.009)
Observations	**8271**	**8271**
Standard errors in		

parentheses		
* significant at 10%; ** significant at 5%; *** significant at 1%		

Note: Results of FY promotion board variables not shown.

2. In-Zone Models

The full sample models establish that the aviation MOS has a statistically significant and negative effect on promotion to O-5, holding other factors constant. The in-zone restricted sample is explored with regression techniques to further analyze the aviation effect with regard to varying effects of other promotion factors, and to conduct sensitivity analysis of the aviation effect itself. Table 48 presents the results of five models of varying specification, estimating promotion effects on the in-zone restricted sample.

Models 1 and 2 have the same specification as their respective full sample models. This step provides the sensitivity analysis of the estimated aviation effect using the full sample. The negative aviation effect persists in the in-zone sample, showing both a negative coefficient and statistical significance at the 1% level. The effect of aviation within the in-zone sample, however, is 1.7 and 2.7 ppts larger than in the respective full sample models.

Models 1 and 2 also demonstrate statistically significant effects of other promotion predictors. Being married, possessing a postgraduate degree, and commissioned from OCC, PLC, NROTC, or the U.S. Naval Academy, all significantly increased the probability of promotion. Finally, Model 2 uses the "critically short MOS," PME, FFGE, and military appearance variables in general specifications. All four factors are statistically significant and in the expected direction. Models 3 and 4 explore these factors in greater detail.

Model 3 introduces refined specifications of the PME and FFGE variables. Completing PME appropriate for the O-4 grade exhibits the expected positive coefficient in Model 2, while Model 3 breaks PME into institutional categories. All institutions have roughly the same practical significance (26.9 to 31.5 ppts) and at the 1% significance

level. The FFGE variable of Model 2 also exhibits the expected negative coefficient, while Model 3 further specifies FFGE by breaking it into specific institution attended for graduate education. However, only NPS and AFIT exhibit statistical significance. The effect of NPS is a lower promotion selection probability of 12.4 ppts, ($p<0.01$) compared to an officer that did not participate in the FFGE program.

Model 3 also includes variables for the effect of combat deployments on promotion probability. As in Model 2, Model 3 captures both the quantitative and geographic effects of combat deployments. Compared to those with no deployment experience, completing one combat deployment increases selection likelihood by 6.0 ppts, completing two deployments increases probability by 10.5 ppts, and three or more deployments increases the likelihood by 10.3 ppts ($p<0.01$). Furthermore, holding number of deployments constant, deploying to Iraq in the grade of O-4 increases promotion selection probability by 5.8 ppts ($p<0.01$). Deploying to Afghanistan does not show statistical significance due to the small sample size in this category, though the sign of the coefficient is positive as expected.

Model 4 adds three more MOS group variables to the specification. The aviation effect of Model 4 is stronger than in any other model, showing an 8.1 ppt lower selection probability ($p<0.01$). None of the other MOS groups' estimators exhibit statistical significance.

Model 5 has the most comprehensive model specification of the in-zone models. Model 5 couples the specification level of Model 3 with the addition of the three extra occupational fields of Model 4. The results of this model demonstrate the statistical robustness of key hypothesized promotion factors across several iterations of model specification, and displays the most refined aviation effect of the study. The aviation MOS exhibits a 7.5 ppt decrease in promotion selection probability to O-5 ($p<0.01$). Additionally, several promotion predictors are consistently significant in the various specifications, with the most refined effect in Model 5. The performance variables are perhaps the most reliable estimators across all models. The Relative Value (RV) continuous variable, the RV stratum variables, and the Reviewing Officer Cumulative Value variable exhibit statistically significant positive effects in all five models ($p<0.01$).

Additionally, the magnitudes of the effects are fairly consistent. The coefficient on RV ranges from a 4.8 to 5.0 ppt higher promotion probability for every 1-point increase in RV above the average (Models 1 and 4). The "RV Upper" variable indicates that those officers whose average RV falls within the upper strata have between a 21.8 and 22.7 ppt higher probability of being selected (Models 2, 3, and 5). Those within the middle RV strata have between an 18.3 and 18.8 ppt increase in selection likelihood. An increase of 1.0 "tree" levels on the RO's comparative assessment (ROCV), from the sample average, increases promotion probability between 35.3 and 35.7 ppts (Models 2, 3, and 5).

Within the training and qualifications category, a rifle expert exhibits an approximate 5.5 ppt higher selection probability (across all five models), whereas the pistol expert effect is not statistically significance. Again, the effect of the military appearance factors are confirmed in the data, exhibiting an expected negative promotion effect of between 9.3 and 13.0 ppts for O-4s who are outside of the height/weight standard, but who are within the body fat standard. The Marine Corps Martial Arts Program (MCMAP) qualifications are not statistically significant, but having an average PFT score within the first class strata increases promotion selection by over 20 ppts in all five models.

Table 48. Probit Promotion Model Partial Effects Results, In-Zone Sample

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Dependent Variable					
Promotion Select					
Explanatory Variable Categories					
Key Variable of Interest:					
Aviation	-0.054***	-0.059***	-0.056***	-0.081***	-0.075***
	(0.019)	(0.020)	(0.020)	(0.023)	(0.024)
Military Occupational Specialty					
Infantry	0.013	-0.001	-0.001	-0.001	-0.017
	(0.024)	(0.027)	(0.027)	(0.028)	(0.029)
Logistics	-0.031	0.002	-0.004	-0.025	-0.016
	(0.030)	(0.031)	(0.031)	(0.033)	(0.034)
Artillery				-0.019	-0.049
				(0.039)	(0.042)
Intelligence				0.006	-0.020
				(0.039)	(0.042)
Communications				-0.006	-0.028
				(0.040)	(0.041)

CriticalMOS		0.050**	0.052**		0.049*
		(0.026)	(0.025)		(0.027)
Performance					
FITRPEP Evals:					
Rel. Value	0.050***			0.048***	
	(0.002)			(0.002)	
RV Upper		0.227***	0.218***		0.219***
		(0.023)	(0.023)		(0.023)
RV Middle		0.188***	0.183***		0.185***
		(0.025)	(0.025)		(0.025)
ROCV		0.357***	0.356***		0.353***
		(0.020)	(0.020)		(0.020)
Training & Education					
Civilian Education:					
Bachelor's Deg	0.196**	0.105	0.088	0.147	0.085
	(0.093)	(0.098)	(0.097)	(0.096)	(0.097)
Master's Deg	0.257***	0.166*	0.139	0.208***	0.136
	(0.073)	(0.085)	(0.086)	(0.080)	(0.086)
PM/PhD	0.207***	0.150**	0.152**	0.172***	0.142*
	(0.052)	(0.071)	(0.069)	(0.065)	(0.072)
Commissioning Source:					
OCC	0.062*	0.075**	0.075**	0.055*	0.074**
	(0.032)	(0.032)	(0.032)	(0.033)	(0.032)
PLC	0.080***	0.080***	0.077**	0.069**	0.078**
	(0.030)	(0.031)	(0.031)	(0.030)	(0.031)
NROTC	0.059*	0.072**	0.070**	0.057*	0.072**
	(0.031)	(0.031)	(0.031)	(0.032)	(0.031)
NavAcadmy	0.068**	0.077**	0.079**	0.075**	0.078**
	(0.032)	(0.033)	(0.032)	(0.032)	(0.032)
Enlisted Program	-0.051	-0.023	-0.025	-0.034	-0.025
	(0.041)	(0.042)	(0.042)	(0.042)	(0.042)
Professional Military Education:					
PME Complete		0.370***		0.371***	
		(0.030)		(0.029)	
Resident USMC			0.310***		0.309***
			(0.014)		(0.014)
Nonresident			0.315***		0.314***
			(0.029)		(0.029)
Resident Other			0.269***		0.268***
			(0.016)		(0.016)
Fully-Funded Education:					
FFGE Any		-0.158***		-0.157***	
		(0.038)		(0.037)	
NPS			-0.124***		-0.123***
			(0.040)		(0.040)
AFIT			-0.206*		-0.211*
			(0.122)		(0.122)
Civ. Univ			-0.129		-0.126
			(0.140)		(0.141)
Marksmanship:					
Rifle Exprt	0.052**	0.057**	0.057**	0.053**	0.058**
	(0.022)	(0.023)	(0.023)	(0.023)	(0.023)

Pistol Exprt	0.017	0.022	0.021	0.025	0.021
	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)
MCMAP:					
Tan Belt		-0.012	-0.018	-0.008	-0.017
		(0.017)	(0.017)	(0.016)	(0.017)
Gray Belt & Abv		-0.006	-0.019	0.001	-0.017
		(0.045)	(0.046)	(0.044)	(0.046)
Physical Fitness & Military Appearance:					
PFT 1stClass	0.268***	0.209***	0.205***	0.237***	0.204***
	(0.047)	(0.051)	(0.051)	(0.049)	(0.051)
BodyFat Stan		-0.094**	-0.128***	-0.130***	-0.093**
		(0.039)	(0.034)	(0.033)	(0.039)
BCP		-0.095	-0.125	-0.210	-0.092
		(0.198)	(0.201)	(0.175)	(0.199)
Height		0.013***			0.013***
		(0.005)			(0.005)
Weight		-0.001*			-0.001*
		(0.001)			(0.001)
Experience					
CombatRpt(binary)	0.095***				
	(0.016)				
1 CombatRpt		0.061***	0.060***	0.053***	0.061***
		(0.019)	(0.019)	(0.019)	(0.019)
2 CombatRpts		0.101***	0.105***	0.100***	0.106***
		(0.027)	(0.026)	(0.026)	(0.026)
3+CombatRpts		0.107**	0.103**	0.136***	0.103**
		(0.051)	(0.050)	(0.046)	(0.050)
IZ Deploy		0.057***	0.058***	0.061***	0.059***
		(0.021)	(0.020)	(0.020)	(0.020)
AF Deploy		0.003	0.009	0.001	0.012
		(0.032)	(0.032)	(0.032)	(0.032)
Demographics					
Female	0.072	0.080	0.067	0.087*	0.070
	(0.046)	(0.050)	(0.048)	(0.046)	(0.051)
Black	-0.081**	-0.029	-0.038	-0.065*	-0.035
	(0.035)	(0.036)	(0.036)	(0.037)	(0.036)
Hispanic	-0.031	0.007	-0.005	-0.027	0.007
	(0.037)	(0.038)	(0.038)	(0.038)	(0.038)
Other Race	-0.056*	-0.074**	-0.092***	-0.077**	-0.087***
	(0.031)	(0.033)	(0.033)	(0.032)	(0.033)
Married	0.087***	0.074**	0.074**	0.076**	0.073**
	(0.032)	(0.033)	(0.033)	(0.032)	(0.033)
Dependents	0.004	0.007	0.005	0.007	0.006
	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Observations	**4208**	**4208**	**4208**	**4208**	**4208**
Standard errors in parentheses					
* significant at 10%; ** significant at 5%; *** significant at 1%					

Note: Results of FY promotion board variables not shown.

3. Aviation Sample Results

The results of analyzing the aviation-only sample are displayed in Table 49. The models do not exhibit an overall significant effect of specific aircrew designation or PMOS (Models 1 and 3). Promotion differences between NFOs and aviators are insignificant, though the sign of the NFO coefficient is negative as expected. The PMOS models estimate the difference in promotion probability from the base PMOS, CH-46E (7562), but none of the PMOS estimators are significant. The fixed-wing aircraft-type community coefficient, however, is significant in Model 2 and shows that fixed-wing aviators have a 5.6 ppt greater likelihood of promotion selection ($p<0.1$) over rotary-wing aviators, holding all other factors constant.

Within the training and education category, only the "Master's Degree and Above" and "PME Complete" variables are significant. The master's degree variable indicated a higher promotion probability of between 23.6 and 24.2 ppts, depending on the base group comparison (Models 1 and 2). PME completion continues to exhibit strong promotion selection significance in the aviation sample. Aviators who complete PME, among all aviation comparison groups, enjoy a 33.9 ppt higher promotion probability.

Within the physical fitness and military appearance category, the body fat variable continues to demonstrate significant and robust estimates in the promotion models. The body fat variable exhibits statistical and practical significance in each aviation model. Aviation officers who do not meet the objective height/weight standard, but are within the body fat standard, have a promotion probability, which is between 15.9 and 16.9 ppts lower than those officers that are within height/weight standards, depending on aviation comparison group ($p<0.05$).

Aviators differentiate themselves for promotion most in individual performance as captured in FITREP evaluations and personal awards. All three FITREP variables (RV Upper, RV Middle, and ROCV) demonstrate both statistical and practical significance ($p<0.01$). Having an average RV within the "upper" strata positively affects selection probability by between 23.2 and 23.5 ppts, depending on aviation comparison group. Those aviators within the "middle" RV strata enjoy a 22.3 and 22.7 ppt higher selection

likelihood. The ROCV estimates show that an increase of one "tree" level above the Reviewing Officer's average comparative assessment increases promotion probability by approximately 40 ppts, holding other factors constant.

Personal awards and decorations are also explored in the aviation promotion model as an additional dimension of performance. The Meritorious Service Medal (MM) exhibited the greatest practical significance on promotion, with a statistical significance at the 1% level in each model estimated. Aviators have an approximate 11.8 ppt increase in promotion for each additional MM awarded, holding other factors fixed. Additionally, the Navy and Marine Corps Commendation Medal (NavyCom) exhibits a similar positive effect on promotion probability, approximately 5.4 ppts per NavyCom.

The officers of the aviation MOS are particularly adept in accumulating Air Medals (Strike Flight, or AS) for flying in the combat environments of Iraq and Afghanistan over the last nine fiscal years of promotion. Therefore, AS awards may be more closely associated with combat experience than individual merit such as the AF medal. However, the aviation promotion model shows that the AS estimate has greater statistical significance than the AF (1% significance level vs. 5%), but is smaller in magnitude. On average, across all aviation models, aviators and NFOs increase their likelihood for promotion selection by 2.2 ppts for every additional AS awarded, compared with 6.3 ppts for every AF awarded.

The experience category estimates confirm that combat deployments positively affect promotion. The greatest statistical significance is estimated in the "two deployments" variable. Aviators that complete two combat deployments in the rank of major (as measured in 180-day combat FITREPs), enjoy an average 14.6 ppt higher promotion probability over aviation officers with no deployment experience in Models 1 through 3 ($p<0.01$).

The squadron experience category demonstrates relatively few significant estimates. Notably, the squadron department head coefficient is insignificant. The most significant squadron effect on promotion selection is the "time-in-the-cockpit" measures of FITREP evaluated time in the squadron as an O-4. An additional month of evaluated

time in the squadron increases selection likelihood by 0.6 ppts in Models 1 through 3, which equates to a practically significant yearly factor of 7.2 ppts ($p<0.01$), holding other factors fixed.

The aviation promotion model's standout estimate is the Weapons and Tactics Instructor (WTI) additional MOS. The WTI variable exhibits a statistically significant estimate in all models tested, at the 1% level. The WTI estimate is also practically significant, affecting promotion probability with a higher selection likelihood of between 22.8 and 23.6 ppts across all three models. Aviators and NFOs that acquire the WTI additional MOS have an approximate 23.2 ppt advantage in promotion probability to O-5 than aviators and NFOs who do not have the WTI MOS. The estimate is also fairly robust for this reason, as there is only a 3.5% difference between the minimum and maximum coefficient values, despite various model specification differences in the key(s) variable of interest.

Table 49. Probit Promotion Model Partial Effects Results, Aviation Sample

	Model 1	**Model 2**	**Model 3**
Dependent Variable			
Promotion Select			
Explanatory Variable Categories			
Key Variable(s) of Interest:			
NFO	-0.029		
	(0.052)		
FW Commnty		0.056*	
		(0.030)	
AV-8B (7509)			-0.013
			(0.132)
F/A-18 (7523)			0.001
			(0.129)
*F/A-18(7525)			-0.049
			(0.141)
MV-22 (7532)			0.136
			(0.114)
KC130(7556/57)			0.063
			(0.123)
CH-46 (7562)			-0.093
			(0.134)
UH-1 (7563)			-0.097
			(0.144)
CH-53D (7564)			-0.105
			(0.154)
AH-1 (7565)			-0.146

			(0.139)
CH-53E (7566)			-0.020
			(0.131)
*EA-6B(7588)			-0.125
			(0.150)
Military Occupational Specialty			
CriticalMOS	0.073	0.061	0.014
	(0.067)	(0.069)	(0.092)
WTI	0.228***	0.232***	0.236***
	(0.028)	(0.028)	(0.029)
FAC	0.006	0.007	0.018
	(0.036)	(0.036)	(0.036)
ASO	-0.018	-0.010	-0.009
	(0.037)	(0.037)	(0.037)
Performance			
FITREP Evaluations:			
RV Upper	0.235***	0.232***	0.236***
	(0.042)	(0.042)	(0.042)
RV Middle	0.223***	0.224***	0.227***
	(0.044)	(0.044)	(0.044)
ROCV	0.403***	0.403***	0.404***
	(0.039)	(0.039)	(0.039)
Personal Awards:			
MeritServ	0.117***	0.122***	0.114***
	(0.036)	(0.036)	(0.036)
NavComm	0.056***	0.054***	0.053***
	(0.017)	(0.017)	(0.017)
NavAchv	0.007	0.007	0.003
	(0.016)	(0.016)	(0.016)
AirMdl IA (AF)	0.064**	0.059**	0.066**
	(0.028)	(0.028)	(0.028)
AirMdl SF (AS)	0.024***	0.020***	0.023***
	(0.008)	(0.007)	(0.008)
Training & Education			
Civilian Education:			
Bachel’s Deg	0.197	0.185	0.173
	(0.185)	(0.185)	(0.187)
Master’s Deg & Abv	0.242*	0.236*	0.227
	(0.136)	(0.137)	(0.140)
Commissioning Source:			
OCC	0.025	0.024	0.024
	(0.063)	(0.063)	(0.064)
PLC	0.046	0.053	0.045
	(0.055)	(0.055)	(0.056)
NROTC	-0.011	-0.006	-0.010
	(0.063)	(0.063)	(0.063)
NavAcadmy	0.056	0.051	0.047
	(0.061)	(0.062)	(0.062)
Enlisted Program	-0.106	-0.103	-0.100
	(0.109)	(0.110)	(0.110)
Professional Military Education:			
PME Complete	0.338***	0.340***	0.338***
	(0.056)	(0.056)	(0.057)

Fully-Funded Graduate Education:			
FFGE Any Institution	-0.088	-0.092	-0.073
	(0.086)	(0.086)	(0.084)
Marksmanship:			
Rifle Exprt	0.090**	0.085**	0.083**
	(0.042)	(0.041)	(0.042)
Pistol Exprt	-0.013	-0.013	-0.010
	(0.030)	(0.030)	(0.030)
MCMAP:			
Tan Belt	-0.023	-0.018	-0.015
	(0.031)	(0.031)	(0.031)
Gray Belt & Abv	-0.042	-0.039	-0.023
	(0.123)	(0.123)	(0.123)
Physical Fitness & Military Appearance:			
PFT 1stClass	0.186**	0.183**	0.183**
	(0.088)	(0.088)	(0.090)
BodyFat Stan	-0.169**	-0.168**	-0.159**
	(0.074)	(0.074)	(0.074)
Height	0.018**	0.017*	0.019**
	(0.009)	(0.009)	(0.009)
Weight	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.001)
Experience			
Combat Deployments:			
1 CombatRpt	0.070**	0.068*	0.070**
	(0.035)	(0.035)	(0.035)
2 CombatRpts	0.143***	0.143***	0.152***
	(0.046)	(0.046)	(0.046)
3+CombatRpts	0.175**	0.183**	0.186**
	(0.082)	(0.080)	(0.078)
IZ Deploy	0.022	0.029	0.042
	(0.038)	(0.038)	(0.038)
AF Deploy	-0.013	-0.005	-0.007
	(0.067)	(0.067)	(0.068)
Squadron:			
Sqdrn Tour	0.014	0.007	0.007
	(0.032)	(0.032)	(0.032)
Sqdrn Mo.s	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)
Sqdrn DeptHd	-0.100	-0.095	-0.098
	(0.068)	(0.068)	(0.069)
Demographics			
Female	0.244	0.237	0.269**
	(0.151)	(0.163)	(0.116)
Black	-0.032	-0.029	-0.022
	(0.095)	(0.095)	(0.095)
Hispanic	0.043	0.043	0.042
	(0.069)	(0.069)	(0.069)
Other Race	-0.021	-0.022	-0.022
	(0.060)	(0.060)	(0.060)
Married	0.052	0.051	0.053
	(0.061)	(0.060)	(0.061)
Dependents	0.010	0.010	0.009

	(0.013)	(0.013)	(0.013)
Observations	**1619**	**1619**	**1619**
Standard errors in parentheses			
* significant at 10%; ** significant at 5%; *** significant at 1%			

Note: Results of FY promotion board variables not shown.

4. Summary of Overall Findings

The multivariate probit model was applied to the research problem. An econometric model was specified that fit promotion selection as the binary response dependent variable, and six categories of explanatory variables. Two sets of specific econometric models were developed and applied to the full sample, five for the in-zone sample, and three for the aviation-only sample. The full sample model analyzed the primary research question regarding the presence of an "aviation MOS effect" on promotion selection to O-5 compared to other MOS groups. The in-zone promotion model focused attention on the various factors which differentiated the purported "aviator effect." Finally, refined models estimated the promotion effects within the aviation MOS, analyzing the factors that differentiated aviators from themselves in promotion competition.

The promotion model results from the full, in-zone, and aviation samples yield answers to the study's primary and secondary research questions. The probability of promotion to O-5 differs for the aviation MOS compared to other large-population MOS groups within the Marine Corps. Specifically, in-zone aviators suffer from a promotion probability disadvantage of 7.6 ppts compared to non-aviation designated in-zone officers (Model 5, Table 48). Expressed in another way, the aviation MOS has a predicted promotion selection rate of 59.7% compared to the sample's overall observed selection rate of 67.3%.

The effect of the aviation MOS on promotion varies somewhat depending on the model specifications, but consistently has a negative effect. The best estimates are found in Model 5 of the in-zone sample, because this model captures the most comprehensive

set of individual characteristics. Several hypothesized promotion factors are confirmed in Model 5. Higher FITREP performance, completion of PME, and better physical fitness all predict higher promotion rate to O-5. Participation in FFGE and being outside of military appearance standard (but within body fat standard) predict lower promotion rate. Finally, statistically significant effects are evident in the critical MOS variable within the full and in-zone samples. Designated "critically short" MOSs by promotion board precept exhibit an approximate 4.9 ppt higher selection probability compared to non-critically short MOSs in Model 5.

The aviation promotion model provides statistically relevant estimates for the competitive factors between aviation-designated officers for promotion to O-5. With minor exception, designated naval aviators and NFOs are on a level playing field with regard to the effect of their given aircrew designation and PMOS in promotion probability. In one model, fixed-wing aviators had a higher promotion probability compared to rotary-wing pilots. For the most part, however, consistent and durable effects are found in the common promotion factors of training and education, fitness, performance, and experience. Some hypothesized promotion factors dealing with aviation specific career experiences were not statistically significant. The colloquial imperative of squadron leadership in department head billets (OpsO and Maintenance Officer) for promotion selection attractiveness did not materialize in the sample's data. However, many other statistically and practically significant variables were found that differentiated aviators in terms of selection probability. Aviation O-4s that are within height/weight standard, qualified WTIs, deploy into combat two or more times, and perform above average in FITREP performance, enjoy a vast advantage in promotion selection probability compared with the average aviator.

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IX. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

The research findings of this study challenge the institutional assumption that Marine Corps officers share the *same* promotability with regard to occupational field. The Deputy Commandant for Aviation (DCA) initiated the research of this study because the aviation MOS had suffered a decreased promotion selection rate to the rank of lieutenant colonel (O-5) over the last decade. Specifically, the study's sponsor asserted that the aviation occupational field (75XX) had experienced lower selection rates than the other "large population" MOS groups of infantry and logistics. Statistical research on a representative sample of the last nine USMC O-5 promotion boards confirmed the sponsor's basic assertion and identified differences across MOS in promotion selection probability to lieutenant colonel. The following conclusions summarize the study's overall statistical findings with respect to the sponsor's research questions and other significant promotion factors. The study concludes with recommendations to the DCA, and Marine Corps headquarters leadership at large, in rectifying the institutional disadvantage of aviators in promotion selection opportunity to O-5.

B. CONCLUSIONS

The study's conclusions are organized by the general order in which the research was conducted, summarizing the significant findings within each area. The overall findings from each research area are then synthesized into a "picture" of Marine officer promotions to O-5 in the final section, which serves as the impetus for the study's final recommendations.

1. Dataset and Samples

The study dataset encompassed the actual USMC O-5 promotion selection eligible population (above and in-zone) from fiscal years 2004 to 2012. The sample is composed of 8,271 observations drawn from TFDW and MMSB, and verified by the

promotion branch of the Marine Corps (MMPR). The in-zone portion of the sample is considered the prime component for statistical analysis of promotion factors, and is within 4% of the actual population. However, the study dataset could have been constructed with 100% accuracy in hindsight. The "further research" section of this chapter details how future Marine Corps promotion research can be accomplished with full population data rather than sample data.

2. Preliminary Analysis

The preliminary analysis consisted of descriptive statistics of three aspects of the study's dataset: full sample, in-zone restricted sample, and aviation-restricted sample. The full and in-zone samples revealed that the aviator occupational field (75XX) represented the largest MOS group, followed by infantry. Analysis of promotion selection to O-5 for the in-zone sample showed that aviation's selection rate was 61.8%, while the overall rate was 67.3%. The sponsor's other "large population" MOS groups, infantry and logistics, promoted at rates of 75.3% and 68.1%, respectively. Additionally, the aviation MOS average FITREP performance was the lowest of all comparison MOS groups as measured by relative value (RV) and reviewing officer cumulative value (ROCV).

Descriptive statistics of the in-zone sample revealed that O-5 selection rates were correlated with several promotion factors. Among all MOS groups, those officers whose PMOS was identified as "critically short" in board precept, who averaged within the "upper" strata of FITREP performance relative value, had completed PME for grade (ILS), averaged in the 1st class PFT strata, scored "expert" in marksmanship, and whose military appearance was within defined height/weight standards, enjoyed a higher promotion rate than those that did not. Additionally, experience as an O-4 in multiple combat deployments and deployments to Afghanistan or Iraq, was associated with higher promotion rates than those who did not deploy. Finally, lower selection rates were associated with other promotion factors such as the aviation MOS, being outside of height/weight but within the body-fat standards, and fully funded graduate education.

3. Multivariate Analysis

Several multivariate models were specified and estimated using maximum likelihood techniques. The correlations between various Marine attributes and promotion were for the most part confirmed in the multivariate modeling. The aviation MOS demonstrated a consistent negative effect in seven models of differing specification and sample composition (full sample $p<0.05$, in-zone sample $p<0.01$), holding other factors constant. The study's "best" model estimates that the aviation MOS has a 7.6 ppt lower promotion probability than a non-aviation Marine officer, holding all other factors fixed (Model 5, Table 48).

The critical MOSs contained in promotion board precepts, PME, physical fitness, marksmanship, and combat deployment experience exhibits positive effects on promotion. The strongest determinant of promotion, however, is individual FITREP performance. Models using the in-zone sample demonstrate that higher FITREP performance (i.e., "upper" strata of RV) increases the promotion probability by approximately 22 ppts. Additionally, an increase of one level on the RO's comparative assessment (ROCV) increases selection by another 35.3 ppts.

On the other hand, participating in the Marine Corps' Special Education or Advanced Degree Programs (SEP/ADP) in receipt of a fully funded graduate education (FFGE) decreases promotion prospects substantially. Specifically, FFGE participants who graduated from the Naval Postgraduate School were estimated to have a 12.3 ppt disadvantage in promotion selection to O-5 compared to those who did not participate in either SEP or ADP ($p<0.01$).

4. Synthesized Conclusions

The study's rigorous data analysis paints a clear picture of what makes a Marine O-4 more attractive for promotion to O-5. Additionally, the statistical findings affirm many present Marine Corps initiatives in performance evaluation and promotion selection ideals. For instance, the promotion selection standard of "best and most qualified" as measured by the Marine Corps' Performance Evaluation System (PES) in FITREP

grading is validated by the data's preliminary and multivariate analysis. The O-4s who performed better in FITREP grading exhibited substantially higher promotion rates than those who performed lower. Furthermore, the effect of individual performance as measured by FITREP grading appears to override any institutional disadvantages in certain MOSs or alternative career paths. In percentage point terms, being in the "upper" RV strata has a greater positive effect on promotion probability than the aggregate negative effect of being an aviator who was an NPS graduate (21.9 ppts > 19.8 ppts; net +2.1 ppts).

However, the statistical findings also indicate possible contradictions within the Marine Corps officer promotion system and the policy ideals of higher education for officers. Besides the "skill guidance" component of board precepts for critically short MOSs, the Marine Corps prides itself in a selection standard that is MOS-blind.

> The board shall carefully consider without prejudice or partiality the record of every eligible officer…because the Marine Corps promotes unrestricted officers within a single competitive category and *not* by military occupational specialty…
>
> —FY2012 USMC LtCol Precept, pg. 3–4

The results of both the preliminary and multivariate analyses indicate the contrary with regard to the aviation MOS (75XX), which exhibits a lower rate of promotion in comparison to the "fleet" average and to other large MOS groups. The study, however, cannot establish casual inference regarding this difference in promotion rate between aviators and other officers. Possibilities include institutional bias against the aviation occupational field in senior officer promotion selection, or self-selection of the better performing officers into non-aviation occupational fields. The performance data suggests the latter, as the aviation MOS had the lowest FITREP averages within the sample. If this is the case, then "better" performing Marines tend to choose, or self-select, non-aviation occupational fields. However, this assessment may also be shortsighted as the aviation field is the only officer MOS that imposes a specific and rigorous entrance exam to screen applicants. Aviation candidates go through the same entrance requirements as

ground MOSs with the addition of the flight aptitude test, which may indicate personal initiative, motivation, and inherent greater performance capability of aviators. If this is the case, then the aviation occupational field may experience a bias in promotion selection or inadequate evaluation by the present FITREP system.

Additionally, the Marine Corps promotes the policy ideals of higher education for officers. The contemporary initiative for better-educated officers appears contradictory to the multivariate effects of the Marine Corps' fully funded graduate education programs (SEP/ADP). Recent guidance by the Commandant of the Marine Corps indicates that graduate education is indeed important for Marine officers, and suggests that it should have a positive effect on promotion probability.

> Improve Special Education Program (SEP) payback policies…Include an assessment of SEP specialties offered at Naval Postgraduate School…The objective is to improve career progression, MOS proficiency, and future competitiveness in order to arm the Marine Corps with more highly-capable officers who are knowledgeable in the many complex disciplines that contribute to improving our 21st Century warfighting capabilities.
>
> Priority #3, 35th Commandant's Planning Guidance (2010)

The Commandant's guidance suggests that a graduate degree from NPS should have a positive effect on promotion probability for officers; however, the data analysis in this study demonstrated otherwise. Like the aviator occupational field discussion, the study cannot establish casual inference regarding this FFGE finding. Possible causes of the promotion selection disadvantage may include that better performing Marines choose, or self-select, non-FFGE career paths, or that the Marine Corps has an institutional promotion bias against SEP/ADP participants.

Finally, descriptive statistics of aviation MOS FITREP performance suggests that either the aviators of the sample were poorer performers or applied higher standards in FITREP grading compared with other MOS groups (see Chapter VI). The latter suggestion is not supported by the study's use of "normalized" FITREP comparison metrics in RV and ROCV. Therefore, the conclusion is that the aviation MOS simply averaged lower FITREP performance than the other comparison MOSs. Notwithstanding

the data evidence to this fact, aviators may not be necessarily poorer performing Marines, but rather evaluated by the wrong set of metrics. The Marine Corps performance evaluation system does not specifically capture the accomplishments of Marine aviators as aviators in a standardized format. Evaluation of Marine pilots and NFOs performing their PMOS duties at operational flying squadrons is surprisingly absent from all official Marine Corps appraisals of Marines' performance. Instead, aviator proficiency data is used only to satisfy requirements in maintaining compliance to the T&R and NATOPS programs. The highly specialized efforts of Marine aviators accomplishing their specific PMOS duties as pilots and NFOs is reduced to a single directed comment within the FITREP, or veiled within the nominal 14 FITREP attributes, which lends only to ambiguous conclusions as to how the Marines performed as aviators.

C. RECOMMENDATIONS

The following recommendations are based upon the statistical findings above on the "aviator effect" on promotion probability to O-5, other significant promotion factors, and the lower average FITREP performance of aviators. Aspects of the following recommendations have been suggested previously in Marine Corps manpower research. CNA's 2006 recommendations to the Marine Corps in remedying chronically under-manned PMOSs included revamping promotion competitive categories, though their attempt was only half-hearted under the title of "Options to alleviate shortages that are unlikely to be adopted" (McHugh et al, 2006, p. 103). The following recommendations include an overhaul of the unrestricted promotion category that bears a close resemblance to the CNA recommendation. Additionally, a recent study by Jobst and Palmer (2005) explored the notion of different performance evaluations based on MOS, though their study did not include analysis of the aviation occupational field. The recommendations presented in this study represent an integrated approach to rectifying the lower promotion rates for the aviation MOS. Recommendations for further research are also proffered in the context of the sponsor's study proposal.

1. Marine Corps Officer Promotion

The aviation MOS is a highly specialized occupational field, which represents a large proportion of Marine field grade officers. Therefore, the existing unrestricted competitive promotion category should be partitioned into a separate aviation competitive category. Aviators would be selected for promotion against other aviators based solely on performance and qualification, without the potential for bias with regard to occupational field in the present system.

Additionally, the remaining occupational fields should also be partitioned in a similar manner. Marine officers should be promoted from within general occupational field specialties. The new competitive categories should represent the Marine Corps' principal warfighting organization, the MAGTF.[16] Three of the four MAGTF core elements can be represented in active-duty officer promotion categories, such as:

- **Ground Combat:** infantry, artillery, and tanks PMOSs
- **Aviation Combat:** all aviator and NFO PMOSs
- **Combat Support:** all other supporting arms PMOSs

Each competitive category is given a promotion selection quantity that is vetted by Manpower and Reserve Affairs (M&RA) for force structuring purposes in long-range health and needs of the institution. The heretofore highly successful promotion selection standard of "best and most qualified" is then applied to the officers within the MAGTF-like competitive categories. The Marine Corps maintains its commitment to equity in promotion opportunity, which should continue to be based on individual merit as quantified in FITREP performance rather than institutional favoritism to race, gender, family status, or PMOS. The Marine Corps also ensures that the structure of the force is appropriately distributed among the general warfighting disciplines and specializations through the recommended system.

[16] MAGTF: Marine Air-Ground Task Force, which is composed of four elements, a Command Element (CE), Aviation Combat Element (ACE), Ground Combat Element (GCE), and Combat Service Support Element (CSSE).

The counterargument to such a sweeping change in the unrestricted officer promotion category is the ethos and culture of the Marine Corps, best represented in "every Marine a rifleman." However, the enlisted promotion system has selected Marines to the next grade from within MOS competitive categories for some time.

> The promotion system provides a process whereby Marines within each grade and MOS/OccFld compete among themselves for promotion to the next grade. The basic goal of the system is to advance the best qualified Marines to higher grades in order that MOS/OccFld vacancies in the enlisted structure will be continuously occupied by Marines who are fully qualified to perform the duties and to assume the responsibilities of the next higher grade.
>
> USMC Enlisted Promotion Manual, para.1201

Does the notion of "every Marine a rifleman" only apply to officers and not enlisted? Or, are enlisted Marines lesser riflemen simply because they are promoted from within an occupational specialty category? The enlisted promotion system has instead struck a balance between promotion opportunity equity and appropriate force structuring, without bias towards particular occupational fields, which is nullified by the construct of their promotion system.

Another counterargument to officer promotion by MOS is that field grade officers, and above, are not "specialists," but rather staff officers. This notion is simply not true. Officers in the rank of lieutenant colonel still have vast opportunity for specialized warfighting, and specifically those of the aviation MOS. Aviation flying squadrons are commanded by O-5s who hold PMOSs appropriate to the T/M/S aircraft specific to the squadron that they command. The reason for this PMOS and squadron aircraft-type matching is that commanding officers of flying squadrons "lead from the front" by participating in operational flying; they are not merely staff officers in charge of the administrative aspects of the squadron. At least to the rank of lieutenant colonel then, officers within the aviation field continue to operate as "specialists" in the warfighting sense.

2. Marine Aviator Performance Evaluation

The recommendation for revamping the active-duty officer promotion categories, coupled with the FITREP performance findings of the aviation MOS, lend to a proposal regarding performance evaluation. The PES should be expanded to include a separate evaluation format commensurate with the new aviator officer promotion competitive category. FITREP performance is the Commandant's primary tool for screening of promotion selection to the next rank/grade, and it is an appropriate system for retaining the best Marines in an equitable fashion. Therefore, the recommendation is to augment the current system with metrics that are explicitly tailored to capture the proficiency and performance of Marine aviators while performing PMOS billets in flying squadron assignments. The idea is to evaluate aviators as aviators while performing their PMOS flying assignments, and thereby screen the best aviators for future rank and increased responsibility. The metrics of aviation performance captured in PES format can include the following:

- Flight hours during the reporting period
- T&R qualifications/designations attained and maintained
- Completed T&R proficiency events
- Completed T&R instructional events as instructors
- Flight leadership proficiency (section/division lead, strategic aerial refueling area commander, etc.)
- Standardized accounting of the accomplishment of squadron department head billets (Operations Officer & Maintenance Officer)

The present construct of shoehorning aviators into an ambiguous and generalized performance evaluation system does not directly measure aviation performance, but rather the degree of accomplishment of ground and administrative responsibilities. The ground duties of Marine aviators at the squadron are necessary to the functioning of the unit, and ultimately to the accomplishment of the squadron's mission. Therefore, the

critique and recommendation does not discount the need for squadron ground billets filled by aviators, or even evaluation of their accomplishment. Instead, the recommendation is to appropriately prioritize which billets are of primary evaluative concern; is it the accomplishment of aviators in ground billets, or rather accomplishments of flying responsibilities for which they are highly and specially trained? Augmenting the PES with an evaluative format for the aviation occupational field will capture the real performance of Marine aviators in the skills for which they are trained. Coupled with the Marine Corps' high degree of reliance upon the PES, the proposed aviator-specific evaluation format will ensure that the senior officer ranks are populated with not only the best Marines, but also the best pilots and NFOs.

3. Additional Recommendations

The statistical analysis of aviator promotion effects also leads to the discovery of other significant promotion factors and implications. The following additional recommendations are listed in an effort to further align Marine Corps promotion policy and performance evaluation with career progression and promotion opportunity.

Given the guidance of the current Commandant of the Marine Corps regarding higher education for officers, FFGE participants should no longer be penalized in promotion selection opportunity for having received a graduate education at NPS or AFIT. The recommendation associated with this problem is to include an additional section to the current O-5 promotion statistical results produced by MMPR. Like the present statistics regarding selection opportunity given gender, race, education level, commissioning source, occupational field, and joint service categories, another set of statistics can be divulged that detail the selection opportunity of SEP and ADP participants. The production of these statistical results in an open venue may help reduce the temptation to penalize officers in promotion opportunity for choosing an alternative career path in pursuit of higher education.

The final recommendation is to incorporate the study's Reviewing Officer Cumulative Value (ROCV) metric into mainstream performance evaluation profiles of ROs. Establishing the RO's average comparative assessment will help them in evaluating

future Marines' performance relative to their own established mean. Additionally, the ROCV can be used in the Master Brief Sheet (MBS) to provide a quick summary metric of MRO performance in RO's comparative assessments, which has been "normalized" and can thus be used as a reliable measure for comparison of MROs' performance.

4. Further Research

The following suggestions relate to further research opportunities with regard to Marine Corps officer promotions in general, and the specific aspects of Marine aviator promotions proposed by the sponsor. The first recommendation applies to all promotion studies and entails the collection of promotion data and in the appropriate order. The order of data collection chosen in this study was appropriate for a sample-based dataset. However, a population-based dataset is possible if an initial list of eligible officers for promotion is secured from the Marine Corps Promotion Branch (MMPR), by fiscal year and promotion zone. A simple list of eligible officers, by promotion zone, does not violate any promotion board privacy code or ethic. Once secured, the MMPR derived list of eligible officers can used to populate variable fields from TFDW and MMSB as accomplished in this study. A population-based dataset may yield even greater statistical significance and thus more reliable estimators of promotion effects.

The next recommendation applies specifically to aviation promotion research. T&R proficiency code data is a key set of variables absent for this study within the aviation-restricted sample. Because the Marine Corps does not officially evaluate aviators in light of their flying proficiency, there are no direct measures of aviation performance within the FITREP data of MMSB. However, analysis of promotion selection effects within the aviation occupational field is incomplete without the direct measures of pilot/NFO proficiency in their PMOS. The T&R data can be collected from the Aviation Training Division (ATD) of the Marine Corps' Training and Education Command (TECOM). Research should then be conducted on the multivariate effects of variables indicative of squadron/MOS leadership in flying proficiency. If there does not exist any statistical difference in promotion probability between aviators of high proficiency and low proficiency, the Marine Corps is not promoting the best pilots and NFOs.

Finally, further research is encouraged regarding the study's main recommendations to reconstruct the active-duty officer promotion categories and the augmentation of an aviator-specific performance evaluation to the PES. The study's proposed recommendations to rectify the disadvantage of the aviation MOS in promotion selection opportunity are complex and require in-depth research prior to implementation. Thorough research should be conducted to validate the statistical results of this study with additional data from the FY2013 O-5 promotion board and beyond, and the addition of T&R proficiency code data as suggested earlier. The focus of later studies should include detailed analysis and recommendations into the creation and implementation of an aviation-specific competitive promotion category, which is aligned with appropriate metrics of aviator performance.

APPENDIX A. FITREP ATTRIBUTE RELATIVE VALUE (ARV)

The FITREP relative value difference between MOS groups, though slight, begs the question of systematic differences in aptitude or evaluative standards between MOSs. However, the RV comparison is too broad of a measure to validate any assertion of this nature. Therefore, the FITREP Attribute Relative Value (ARV) is used to investigate micro-differences in MOS groups across all FITREP attributes (Chp. V for detailed ARV explanation). Twelve of the fourteen FITREP attributes are represented in Table 50 for MOS comparison. The scale of ARV is from 1.00 to 7.00.

The aviator MOS had the lowest overall average ARV of the two main comparison groups, infantry and logistics, for every FITREP attribute as detailed in Tables 50 and 51. This finding is consistent with the macro-level analysis of RV, the aviation MOS demonstrated lower overall FITREP performance than all other MOS groups of the sample. Aviation average ARVs differ the most with the infantry occupational field. The difference, however, is slight. For example, aviation and infantry differ within the "Courage" attribute by 0.16 ARV, which represents only a 4.2% difference in ARV for that attribute. Within the selected for promotion category, infantry averaged 3.9% higher ARV in "Courage," and 3.8% higher in "Effectiveness Under Stress" (difference of 0.15 ARV respectively). "Setting the Example" is aviation's weakest FITREP attribute compared to infantry, for selected officers. Aviation's average ARV trailed infantry by 0.16 ARV, which represents a 3.9% difference. Alternatively, aviation's selected officers averaged higher than infantry within the "Mission Accomplishment" and "Mission Proficiency" attributes, though the difference is minuscule at 0.04 ARV respectively (or 0.9%). Suffice it to say, ARV analysis of FITREP performance differences between the study's comparative MOS groups reveals that there are only minor differences in specific attributes. The "overall average difference" statistic (bottom row, Table 50) demonstrates the consistency of average ARVs across all FITREP attributes and MOS groups. See Table 51, "ARV Raw Table" for further analysis.

Table 50. ARV Comparison, by MOS Group

	MOS Category	M. Accom.	M. Prof.	Courage	Stress	Initiative	Leadrshp	Develpng	Example	Well-being	Comm	Dec. Mkng	Judgmt
Aviation ARV	Aviation O/a[17]	4.56	4.26	3.73	3.85	4.25	3.99	3.82	4.01	3.85	3.99	4.04	4.06
	Selected	4.69	4.37	3.77	3.91	4.35	4.06	3.88	4.08	3.88	4.05	4.10	4.12
	Non-Selected	4.36	4.07	3.66	3.76	4.10	3.88	3.71	3.90	3.82	3.90	3.95	3.95
Aviation's Difference in ARV	All MOSs O/a	0.01	0.00	-0.05	-0.05	-0.06	-0.05	-0.04	-0.07	-0.05	-0.08	-0.02	-0.01
	Selected	0.03	0.02	-0.05	-0.05	-0.05	-0.04	-0.05	-0.07	-0.04	-0.08	-0.03	-0.02
	Non-Selected	0.03	-0.01	-0.02	-0.01	-0.02	-0.02	-0.03	-0.03	-0.02	-0.03	0.02	0.02
	Infantry O/a	-0.02	-0.01	-0.16	-0.17	-0.13	-0.16	-0.14	-0.17	-0.11	-0.12	-0.06	-0.04
	Selected	0.04	0.04	-0.15	-0.15	-0.08	-0.14	-0.10	-0.16	-0.10	-0.11	-0.05	-0.03
	Non-Selected	-0.01	-0.04	-0.14	-0.14	-0.13	-0.10	-0.17	-0.11	-0.06	-0.06	-0.01	0.00
	Logistics O/a	-0.01	-0.01	-0.08	-0.08	-0.09	-0.09	-0.07	-0.12	-0.10	-0.10	-0.07	-0.03
	Selected	-0.01	0.00	-0.08	-0.08	-0.09	-0.08	-0.06	-0.12	-0.10	-0.11	-0.07	-0.04
	Non-Selected	0.06	0.02	-0.06	-0.04	-0.02	-0.05	-0.07	-0.08	-0.07	-0.04	-0.02	0.00
	Other MOSs O/a	0.04	0.01	-0.05	-0.05	-0.08	-0.04	-0.05	-0.08	-0.06	-0.12	-0.02	-0.01
	Selected	0.06	0.05	-0.06	-0.06	-0.07	-0.04	-0.05	-0.09	-0.06	-0.13	-0.03	-0.02
	Non-Selected	0.07	-0.01	-0.01	0.00	-0.03	-0.01	-0.01	-0.02	-0.03	-0.06	0.05	0.05
Avg Diff's in ARV	Avg Diff O/a	0.00	0.00	-0.09	-0.09	-0.09	-0.09	-0.08	-0.11	-0.08	-0.11	-0.04	-0.02
	Avg Diff Sel	0.03	0.03	-0.09	-0.08	-0.07	-0.08	-0.07	-0.11	-0.08	-0.11	-0.05	-0.03
	Avg Diff Non-Sel	0.04	-0.01	-0.06	-0.05	-0.05	-0.05	-0.07	-0.06	-0.05	-0.05	0.01	0.02
	Overall Avg Diff	**0.02**	**0.01**	**-0.08**	**-0.07**	**-0.07**	**-0.07**	**-0.07**	**-0.09**	**-0.07**	**-0.09**	**-0.03**	**-0.01**

[17] O/a: Overall measure that includes both "selected" and "non-selected" officers.

Table 51. Raw ARV Table, by MOS Group

MOS Category	M. Accom.	M. Prof.	Courage	Stress	Initiative	Leadrshp	Develpng	Example	Well-being	Comm	Dec. Mkng	Judgmt
All MOSs O/a	4.55	4.26	3.78	3.90	4.31	4.04	3.86	4.08	3.90	4.07	4.06	4.07
Selected	4.66	4.35	3.82	3.96	4.40	4.10	3.93	4.15	3.92	4.13	4.13	4.14
Non-Selected	4.33	4.08	3.68	3.77	4.12	3.90	3.74	3.93	3.84	3.93	3.93	3.93
Aviation O/a	4.56	4.26	3.73	3.85	4.25	3.99	3.82	4.01	3.85	3.99	4.04	4.06
Selected	4.69	4.37	3.77	3.91	4.35	4.06	3.88	4.08	3.88	4.05	4.10	4.12
Non-Selected	4.36	4.07	3.66	3.76	4.10	3.88	3.71	3.90	3.82	3.90	3.95	3.95
Infantry O/a	4.58	4.27	3.89	4.02	4.38	4.15	3.96	4.18	3.96	4.11	4.10	4.10
Selected	4.65	4.33	3.92	4.06	4.43	4.20	3.98	4.24	3.98	4.16	4.15	4.15
Non-Selected	4.37	4.11	3.80	3.90	4.23	3.98	3.88	4.01	3.88	3.96	3.96	3.95
Logistics O/a	4.57	4.27	3.81	3.93	4.34	4.08	3.89	4.13	3.95	4.09	4.11	4.09
Selected	4.70	4.37	3.85	3.99	4.44	4.14	3.94	4.20	3.98	4.16	4.17	4.16
Non-Selected	4.30	4.05	3.72	3.80	4.12	3.93	3.78	3.98	3.89	3.94	3.97	3.95
Other MOSs O/a	4.52	4.25	3.78	3.90	4.33	4.03	3.87	4.09	3.91	4.11	4.06	4.07
Selected	4.63	4.32	3.83	3.97	4.42	4.10	3.93	4.17	3.94	4.18	4.13	4.14
Non-Selected	4.29	4.08	3.67	3.76	4.13	3.89	3.72	3.92	3.85	3.96	3.90	3.90

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APPENDIX B. PRECEPT CRITICAL MOS

Promotion Board Precept	Critically Short MOSs
FY2012	0180/3404/5803/6002
FY2011	0180/6002
FY2010	0180/1302/5803
FY2009	0180/02XX/3404/4302 7543/7556/7557
FY2008	0180/02XX/4302 7543/7564
FY2007	0180/02XX/0402/0602 1302/3404/4302/6002 6602/7543/7557/7564
FY2006	0180/02XX/0602/1302/3404 4302/6002/7543/7557
FY2005	0180/02XX/1302/3404/4302 7543/7557
FY2004	0180/0202/0602/1302/3404 4302/6002/7543/7557/7564

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